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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

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A MONTHLY JOURNAL RELATING TO THE METAL AND PLATING TRADES

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GAUTIER'S

THE METAL INDUSTRY
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OLD SERIES Vol. 22. No. 4. NEW YORK, APRIL, 1916. NEW SERIES Vol. 14. No. 4.

THE MANUFACTURE OF BRASS CARTRIDGE CASES

A Description of Modern Methods Pursued by a Large Concern For the Physical and Chemical Treatment of These Important Munition Articles.

By G. C. Holder.*

The present day struggle of European countries has opened a wide field for the physical metallurgist. The activity in the ammunition manufacture has brought forth the necessity of having a man versed in both physical and chemical properties of alloys in immediate touch with the daily production. In the course of production, cleaning, heat treating and pickling are among the most important duties of the physical metallurgist, although the choosing of drawing compounds and cleaning mediums fall within his scope, as well as chemical analysis, Macro and microscopical and physical testing of the material used as well as the finshed product.

As before stated, the heat treatment or annealing of the brass and its subsequent cleaning operations are the major duties, because production is the password for all present day manufacturing plants, and since after each drawing operation it is necessary to clean, anneal and pickle the brass, it is highly important that things work with clock-like precision if the amount of production be maintained, especially where the plant has a daily output of from 20,000 to 24,000 cartridge cases per day. In the manufacture of cartridge cases, one word is of paramount importance, and that is cleanliness. No dirt or grit is permissible, as it will certainly be evident in the finished product.

A DOUBLE CHAMBER OIL FUEL BRASS ANNEALING FURNACE, DESIGNED AND INSTALLED BY W. S. ROCKWELL COMPANY, NEW YORK, N. Y. NOTE THE RAMS FOR PUSHING IN THE WORK

DESCRIPTION OF MATERIAL USED.

The brass discs are received from the manufacturer in lots of 10,000, the size of a disc for a 11.58 inch or 18 pound British shell is 6.375 x .380 inch, and are in the annealed state, and are supposed to contain 67% copper and 33% zinc, small amounts of impurities being

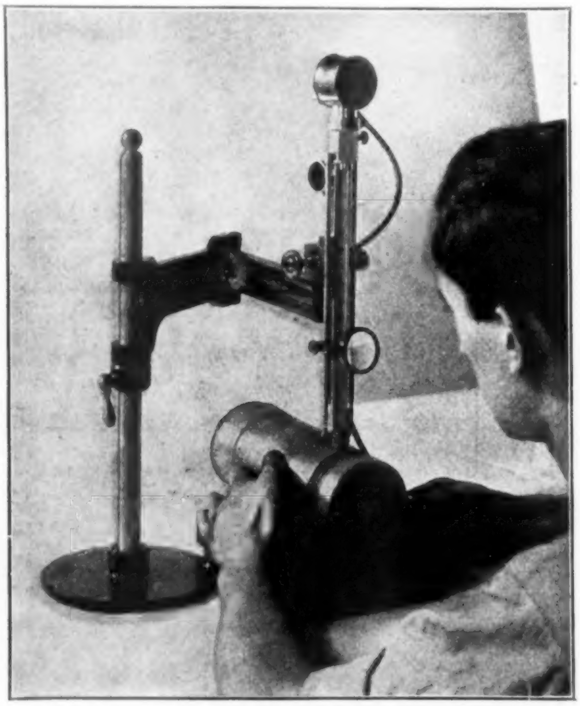
*Metallurgist and Metallographist.

allowed. The following analysis being typical of a shipment:

Copper	Zinc	Lead	Iron	Tin
68.04%	31.85%	.060%	.018%	None
67.78%	32.13%	.055%	.028%	None
68.92%	30.96%	.050%	.030%	None

Here the first duties of the metallurgist appears. The macro and microscopical examination is made relative to dirt and oxides in the metal, as well as the crystalline structure relative to its state of anneal. Ten or fifteen discs are selected at random from a lot of 10,000. Scelerescopic readings are taken of the brass discs as well as tensile strength.

The Scelerescope reads generally 15, and the Brinell hardness 69.



TESTING HARDNESS OF HIGH-EXPLOSIVE SHELLS WITH THE SCLEROSCOPE MADE BY SHORE INSTRUMENT COMPANY, NEW YORK.

The following physical properties are typical of the material used:

16,500 pounds per sq. in. elastic limit.
16,330 " " " " "
37,040 " " " ultimate.
36,540 " " " "
57.5% elongation in 2"
54.5% " " 2"

The number of annealing, cleaning and pickling operations are as follows:

1 Cupping	15 Clean and dry
2 Cleaning	16 3rd draw
3 Anneal	17 2nd indent
4 Pickling	18 Anneal
5 Clean and dry	19 Pickling
6 1st draw	20 Clean and dry
7 Cleaning	21 4th draw
8 Anneal	22 Cleaning
9 Pickling	23 Anneal
10 Clean and dry	24 Pickling
11 2nd draw	25 Clean and dry
12 1st indent	26 5th draw
13 Anneal	27 Cleaning
14 Pickling	28 1st trim
29 Anneal	34 Cleaning
30 Pickling	35 Heading
31 Clean and dry	36 Semi-anneal
32 6th draw	37 1st taper
33 2nd trim	38 2nd taper

ANNEALING.

The annealing is done in large muffle double chamber furnaces, as shown in Fig. 1, oil being used as a fuel and superheated steam as an atomizing medium. The furnaces have a capacity of about 1,700 per chamber per hour.

The time and temperature for different draws follow:

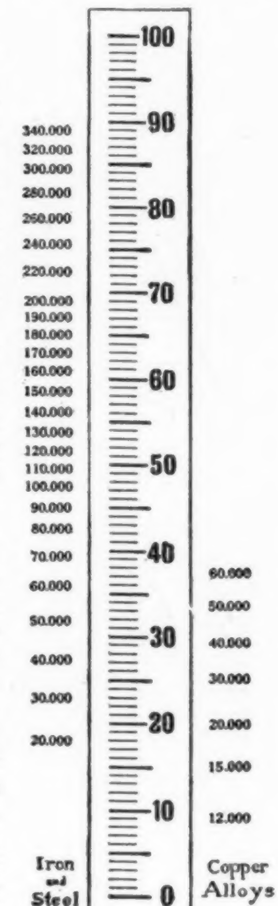
Cupping		
1st draw	....45 min.	1160° F.
2nd draw	....45 min.	1160° F.
3rd draw	....40 min.	1160° F.
4th draw	....40 min.	1060° F.
5th draw	....35 min.	1060° F.

The above times and temperatures are arbitrary, but owing to variable conditions, it is wise to give sufficient leeway, and not work too close to high and low limits in annealing. Furthermore, the above figures have worked satisfactorily in practice.

PICKLING VATS

After each anneal and for all anneals up to the fifth or up to operation 30, a sulphuric acid pickle of the approximate strength of 16 parts of water to 1 part of 66 degs. Baume, sulphuric acid is used. This is maintained at a temperature of 150 degs. F.

After the final anneal or operation No. 29, the final pickle or operation No. 30 is used—10 parts of water to 1 part of 66 degs. Baume sulphuric acid with an addition of 60 pounds of sodium dichromate ($Na_2Cr_2O_7$) to 300 gallons of water and acid, maintained at a temperature of between 125 degs. Fahr. and 145 degs. Fahr. This pickle is used to eradicate copper spotting and will cause the brass to come out a beautiful yellow color. The greatest trouble encountered in pickling baths is the copper color, which may be produced by various causes, such as metallic iron, local annealing caused by grease and dust adhering to the brass when in the annealing furnace, or oil burning in from the drawing compound while the metal is being drawn. However, the most prevalent cause is iron being introduced by small particles adhering to the brass from the steel or iron pans used in the annealing furnaces. Therefore the use of chromium salts which arrest all galvanic action, chromic acid also being a good cleanser for dirt and grease. The galvanic action is produced because of metals of different potentials being introduced into an electrolyte. The pickling baths will from time to time need strengthening and renewal; most of the attention must be di-



Hardness

A table of elastic limits (tensile) symbolized by the scleroscope hardness units.

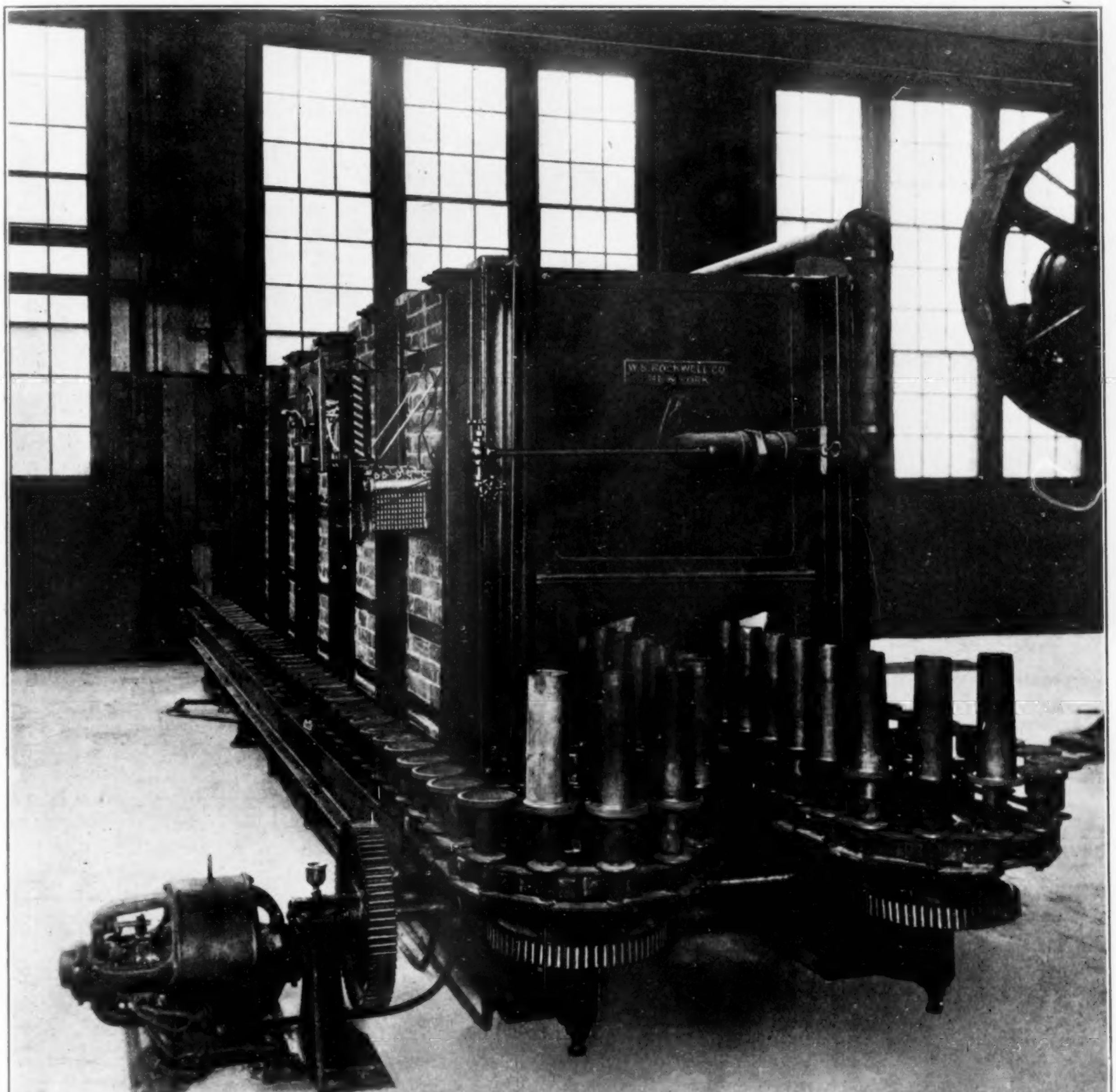
rected towards the final pickling bath. The length of life of this bath is about two weeks, the same being used day and night, six days a week.

The length of time the brass cartridge cases remain in the pickle depends upon conditions but generally from two to eight minutes. The pickling baths are suitably lead lined tanks. The brass cases after being sufficiently cleaned are then placed into a tank of clean water kept at a temperature of about 100 deg. Fahr.

After each drawing operation the cartridge cases must be cleaned and well cleaned before annealing. Compounds for this purpose are on the market and compound used and the condition of the cases as to dirt and grit.

The rinse water tank should have an inlet at the bottom and an outlet at the top of the tank, so that clean water is present at all times..

After the final or sixth draw the cases are again cleaned before going to the heading press. The bath is composed of 4 ounces of sulphuric acid to a gallon of water, and kept at a temperature of about 180 deg. Fahr., the cases are then rinsed in hot water and are ready for the header. No dirt, grease or water is allowed to remain in the cartridge cases before heading, and with that end in view they are rinsed out with gasoline.



AN "END" ANNEALING FURNACE, DESIGNED AND INSTALLED BY THE W. S. ROCKWELL COMPANY, NEW YORK, N. Y. IN THIS FURNACE ONLY THE ENDS OR TOPS OF SHELLS ARE SUBJECTED TO HEAT, HENCE THE NAME "END."

instructions are given as to their proper usage. Generally the cleaning bath when newly made up has a gravity of from 5 to 6 deg. Baume. The bath should be kept hot as well as the rinse water. The length of time in this bath is about two minutes, again depending upon conditions: Namely—kind of drawing

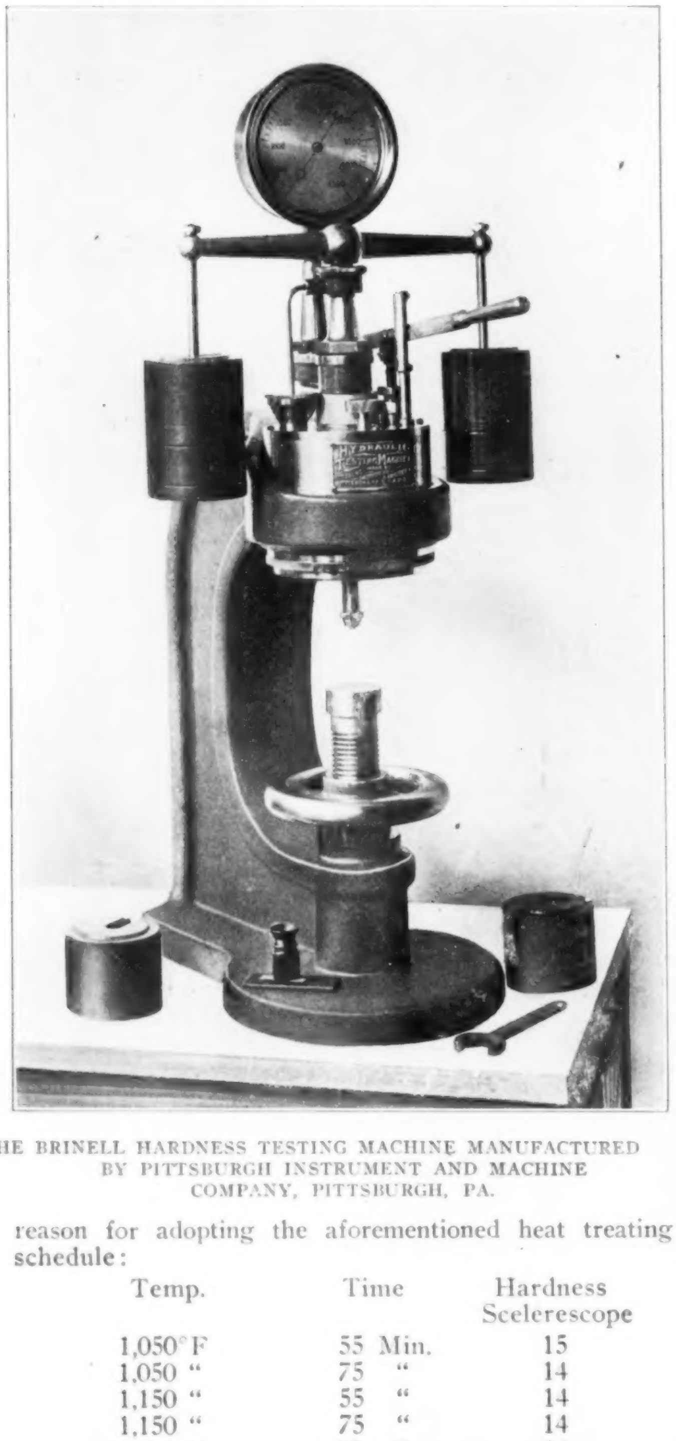
After heading they go to what is called the flash—anneal furnace, and are annealed at about 900 deg. Fahr., when they go to the tapering press; after tapering different machining is done. They are then inspected as to minimum and maximum height, thickness of walls and flange, and depth of primer hole. The

primer hole is hand tapped, when they are again inspected, as to correctness of threads. After that they are stamped. They are then taken to the final wash.

THE FINAL WASH

This consists of 8 ounces of soda ash to a gallon of water, kept at near boiling temperature. After a chance has been given for this to act, they are rinsed in hot water, then into weak sulphuric acid bath, composed of 4 ounces to a gallon of water, and then into a final hot water bath, then allowed to drain. The cases are all now ready for final inspection.

The following figures will show more explicitly the



THE BRINELL HARDNESS TESTING MACHINE MANUFACTURED BY PITTSBURGH INSTRUMENT AND MACHINE COMPANY, PITTSBURGH, PA.

reason for adopting the aforementioned heat treating schedule:

Temp.	Time	Hardness Scelerescope
1,050° F	55 Min.	15
1,050 "	75 "	14
1,150 "	55 "	14
1,150 "	75 "	14
1,200 "	60 "	14
1,250 "	60 "	14
1,350 "	35 "	11

Unannealed Scelerescope Reading 20-Bottom 45-47 sides.

The above tests were made on the first operation or cupping.

Physical properties of a finished case sample taken near mouth:

37,500 pounds per sq. in. elastic limit.
49,332 pounds per sq. in. ultimate
30% elongation in one inch.

Sample taken near base:

36,420 pounds per sq. in. elastic limit
50,000 pounds per sq. in. ultimate
29.5% elongation in one inch.

Weight of a finished case:

Pounds	Ounces	Drams
3	0	6

Cubical content:

95.50 cubic centimeters

STELLITE

A Few Facts Regarding Machine Tools Made from the Alloy.

The virtue of the Stellite tool lies in its ability to maintain its cutting edge at a high rate of speed at temperatures which would immediately cause the failure of any known tools containing any notable quantity of iron. Its great *hardness* and resistance to *abrasion* at all working temperatures are likewise valuable properties.

Owing to the fact that Stellite retains its hardness even at a full red heat it cannot be forged. This fact, however, is rather a virtue than a detriment so far as use is concerned, because if the alloy would soften sufficiently for forging when heated it would, of course, immediately lose its cutting edge at the same temperature and this would limit its usefulness to a marked degree.

From the above fact Stellite can only be reduced to the desired form by casting it in dies in the form of bars which are afterward ground to a cutting edge. Its capabilities as a lathe tool are now universally acknowledged, though in certain cases failures have resulted, due to improper knowledge of the alloy and its peculiarities. It should be remembered that it is *not a steel* and therefore requires special handling, which enables the operator to utilize its valuable properties to the best advantage.

Without going into the method of handling the alloy, some results obtained by its use would, perhaps, not be out of place. It was recently ascertained that a 3/8" sq. x 2½" long piece of Stellite, ground to the form of a grooving tool, cut 14,000 grooves in cast iron pistons ranging from 3½" to 4⅜" in diameter before it became too much worn off for further use. This work was performed in regular practice and not as a test. A still more remarkable and more recent performance has just come to light in the same factory. A Stellite tool of the same dimensions as that mentioned above, but which was ground to the round nose form and used for turning pistons, turned off more than 8000 pounds of cast iron before becoming too short for use. Considering only the portion of the tool which was actually ground away, the tool turned off 1,000 times its weight of cast iron before becoming too short for service.

Both of the above tools were made especially for turning cast iron. Another combination is used for turning steel, which has also shown equally remarkable results. These tools are now being used extensively for turning shrapnel shells at high speed for the European war.

While long wear is an important property in a lathe tool, it is not the essential or most valuable property. The value of the tool, even at the comparatively high price of Stellite sinks into insignificance when compared with the value of the *time* saved.

CLASSIFICATION OF SCRAP MATERIAL AT THE NAVAL GUN FACTORY *

A Report of How Uncle Sam Saves Money by Conservation of Waste.

By E. W. Bonnaffon, Pay Inspector, U. S. Navy.

The following outline is given of the extent of the classification of scrap material at the Naval Gun Factory. This phrase of industrial economy has primarily to do with the segregation or sorting of this material, either for further use or future sale.

The efforts made by the gun factory along these lines have simply kept pace with similar activities in other commercial establishments.

The underlying purpose is two-fold: to so sort the scrap as to permit its being used advantageously in the plant (that is as raw material in manufacture), or so that it may be sold at a higher price.

The question always uppermost in deciding just how far to go in this work must be "Will it pay?" To answer this intelligently the cost of handling, sorting and storing must be considered together with the possibilities of its use, and the probability of the proceeds of sale if disposed of in that way. This requires a knowledge of the market prices of these various materials and also a knowledge of industrial operations.

The advice and suggestions made by the Inspection Department have been most valuable and this coöperation has materially assisted the systematic handling and use of scrap.

The primary "don't" in this business is not to mix scrap. This lies as the foundation of all later results. To illustrate the importance of this first step it must be borne in mind that all turnings from the shops, which are mixed, as, for instance, brass and bronze turnings with steel, are of relatively little value. Each kind of metal must be kept absolutely separate.

It is possible to divide the metals by means of a magnetic separator into ferrous and non-ferrous, and this is done whenever necessary, but it is not feasible to further divide the fine particles of brass and bronze, etc. They should be kept from steel turnings, however, as their presence reduces materially the value. Hence the necessity of placing the trays right at the machine to receive the turnings as they come from the work.

Any mistakes made through ignorance or carelessness are costly. Valuable scrap material is often mixed so that it is either unfit for use or cannot be sold to advantage. To accomplish this satisfactorily the separation must be made as near the work as possible. For instance, suitable receptacles are distributed through the shops and, when possible, at the machines, to receive the different kinds of scrap, since it is just as easy to place the material separately at the start of the process, and then the character of the material is absolutely known, rather than later when it would be necessary to add additional labor to sort it out, and the kind of material might be in doubt.

To show that the accumulations of this material at the gun factory are sufficiently large and valuable enough to warrant special attention, the following list is given of the annual output, with the prices received from sale or its estimated value to the plant when used:

	Pounds.	Per lb.
Nickel-steel borings and turnings.	500,000	$0.005
Carbon-steel borings and turnings	1,500,000	.003
Cast-iron borings	100,000	.003
Carbon-steel (shoveling and charging stock)	500,000	.003
Cast-iron (usable sizes)	400,000	.005
Pipe and tubing	100,000	.004
Burnt iron	150,000	.005
High-speed steel	1,700	,07
Miscellaneous large scrap steel and wrought iron	1,000,000	.004
Galvanized iron	60,000	.0015
Sheet steel	60,000	.0025
Cast iron (too large for use)......	100,000	.003
Brass foundry ashes	550,000	.003
Brass foundry skimmings	50,000	.035
Broken crucibles	50,000	.003
Dross	101,000	.07
Shop sweepings	90,000	.035
Emery grindings	8,000	.10
Solder dross	2,000	.05
Brass turnings	200,000	.10
Ordinary bronze turnings	200,000	.12
Manganese-bronze turnings	40,000	.10
Cupro-nickel turnings	10,000	.10
Copper	20,000	.12
Ordinary bronze	250,000	.12
Manganese-bronze	50,000	.10
Brass	100,000	.10
Waste paper, printed	10,000	.0125
Do., wrapping and sweepings....	20,000	.007
Do., card board	20,000	.007
Dirty and oily waste	....	...
Copperas (ferrous sulphate)	....	...
Residue of oxy-acetylene plant...	5,000	.01
Rope and cuttings	24,000	.025
Rubber	4,500	.02
Leather	2,500	.06

All of this material that can be utilized in the plants is turned into store at a price established by a board, and when drawn out is charged in the same way as new material. The credit given in this way to the shop or job is an incentive to the manufacturing department to save and to recover the waste.

The prices are based on a reasonable estimate of the market value of the actual contents plus the cost of putting into usable shape. For instance, brass turnings which analysis shows contains 70 per cent. copper and 30 per cent. zinc would depend on the market price of copper and that of zinc, and in the ratio of 7 to 3, together with the cost of melting into ingots. The prices fixed ignore temporary fluctuations.

The nickel-steel turnings, practically all of which are obtained from work in the gun shop, upon being collected in large tubs are sent direct to the foundry for use in the open-hearth furnace.

The carbon-steel of suitable size (what would be termed in the trade as shoveling or charging stock) is also used in the open hearth.

The cast iron is placed in a separate bin and broken under a derrick installed for this purpose, and later used in the foundry.

All the rest of the steel and iron is sold.

The non-ferrous metals, which include turnings, scrap, etc., of brass, bronze, manganese-bronze, copper, etc., are collected and sorted in an enclosure adjacent to the foundry and near to the furnace in which

*Journal American Society of Naval Engineers, February, 1916.

it is to be melted. This material enters very largely into the manufacture of all brass and bronze castings, approximately 70 per cent. being used as against 30 per cent. new on purchased metals.

Baling machines are used to put the stringy or fluffy turnings into convenient shape for charging into the furnace, and a machine is being devised to compress the finer turnings and borings into briquettes, so that when it is of known analysis it may be melted directly in the crucible. To show the remarkably satisfactory results obtained in the use of scrap non-ferrous materials with—

800 pounds Tobin bronze turnings,
1,000 pounds dross and skimmings,
800 pounds condenser tubes,
300 pounds manganeze-bronze scrap,
500 pounds Tobin-bronze stampings and trimmings,
45 pounds aluminum-zinc scrap,
110 pounds cupro-manganese hardener,
260 pounds sheet-zinc scrap,
260 pounds slab zinc,

it has been possible to manufacture manganese-bronze of the following analysis and characteristics:

Chemical:

Copper, 59.88; zinc, 38.08; tin, .62; lead, .40; manganese, .08; aluminum, .66; iron, .28.

Physical:

Tensile strength.	Yield point.	Elongation.
68,805 pounds.	36,160 pounds.	26.1 per cent.
65,393 pounds.	39,126 pounds.	36.05 per cent.
67,990 pounds.	33,104 pounds.	30.05 per cent.

Waste paper is collected in the various offices and at the same time separated into classes for sale. Arrangements are being made to recover all oily or used cotton waste and clean and dry it for further use incidentally obtaining the oil for use.

Copperas is obtained as a by-product from the process of cleaning and treating (pickling) sheet metal with sulphuric acid. It will be sold, and is valuable as a disinfectant. Methods are also being devised for the recovery of bluestone or copper sulphate from the pickling bath in the cartridge-case shop.

The residue resulting from the manufacture of oxygen in the oxy-acetelene plant consists of muriate of potash and binoxide of manganese, which is a very valuable ingredient of fertilizers and is disposed of periodically for that purpose.

Rope, rubber and leather are obtained from various sources, principally from remnants resulting in manufacture.

ELECTRIC FURNACES FOR MELTING BRASS

A Few Pertinent Remarks in Relation to the State of the Art.

By W. H. Parry*

That the ideal method of melting brass is in an electric furnace there can be no doubt, as the air is excluded and the melting loss or shrinkage is all but nil. The prohibitive cost of these furnaces with full electrical equipment has stopped many a firm from installing them, and until the manufacturers of these outfits come down to earth there is very little possibility of their universal adoption by brass founders.

When a price of forty-five hundred dollars as asked for a shell made of boiler steel lined with fire brick, and only big enough to melt five hundred pounds to a heat at that, it is about time to sit up and take notice. When asked to explain how such a price could be asked, the salesman hid behind that ever-present haven in times of stress, the enormous cost of perfecting the furnace to bring it out of its laboratory stage to the manufacturing and practical condition demanded by the business man of today. In other words the first buyers of these furnaces are asked to pay for the experimentation necessary to bring the furnace up to a point where it could safely be placed in the hands of men other than electricians and technical school graduates.

It also follows that to successfully operate any of these furnaces the prices paid for the current is a most important factor, and if the many "Edison" companies throughout the country would only adopt a more liberal policy in the way of charging the very minimum rate to the users of current for purposes other than lighting, more of them would be used.

The great advantage that the electrical furnace has over any of the others, open flame or crucible, is that chips can be melted with but very little loss and without any preliminary preparation, such as bricketting or being mixed with a fluxing compound. In any plant making their own current these furnaces can be operated at no greater expense than any of the other furnaces, either fuel, oil, coke or coal fired, and even at this early stage of their development it is a question whether they cannot be operated cheaper.

Within the past two weeks an electrical furnace has been exploited by its promoters which, if their statements can be taken seriously, would mean ruin to the makers of the old-style furnaces. The chief claim for this furnace being that, starting with the first heat in the morning at a certain number of kilowatts used to melt one hundred pounds of metal, the amount of current consumed in each succeeding heat grows less and less until at the end of the day the furnace almost makes its own current. Of course, this claim is absurd, the more so when it was learned that the electrical furnace in question is still in its laboratory stage, which means one of two things, either it will never graduate therefrom or, if it ever does, the amount of current used will always be relative to the work accomplished.

Still another electrical furnace is now being pushed to the front through the medium of display advertisements. This furnace is of the flaming arc type and does not need the metal to complete the circuit. It is claimed for this furnace that the electrode consumption is only from 2½ to 5 pounds per ton of metal and the roof of the furnace will last four hundred heats without re-lining. This last assertion is intended to convey to prospective users that such a good wearing lining is exceptional, whereas any fuel oil furnace that cannot stand up to at least a thousand heats ought to be fired to the scrap heap.

As the melting point of brass is fixed, why should not the lining of an electrical furnace last as long as any other? In fact, they ought to last longer, as the melting point would be less in a partial vacuum than in any furnace that depends on air to complete the combustion. This last furnace, by the way, is of foreign design and manufacture and, while pretty freely advertised by its promoters, an inquiry for one furnace developed a beautiful case of the "blind staggers" on their part; while explaining that they were in no position to make deliveries in this country just now because "Johnny Bull" and his side partners, "Parley Voo" and "Solid Ivory Russo," were too busy dodging "Heinie" bullets.

* Superintendent of National Meter Company, Brooklyn, N. Y.

PREVENTIVE MEASURES AGAINST SPOTTING OUT

An Exhaustive Article Which Is the Last Word in this Annoying Problem.

By Fred Ottman.

The Metal Industry has been quite silent during the last year on spotting out complaints, although the last word in the controversy has not yet been said, and whenever a plater sees a chance to unbosom his heart, he will tell you of his troubles and ask for your advice.

The first time the writer was confronted by the problem was in a large New England hardware factory some sixteen years ago. The foundries were in very good hands, and although immense quantities of castings were handled daily, spotting was practically unknown, when one fine day a consignment of butts, solid bronze in statuary finish, was returned from the lacquer kilns with faded knuckles. A strong magnifying glass showed the knuckles to be dotted with countless minute holes, and a fine ring of bare metal around every hole. The articles were carefully refinished, kept in the workroom for several days to be sure the trouble would not recur, then lacquered and, returned in the same bad condition. The trouble was traced to the caustic potash, and when a boiling solution of soap was substituted, it ceased. Apparently the boiling water, in which the finished articles were dried, rinsed off the extruding potash before it had a chance to attack the oxidation, but the dry heat of the lacquer kiln gave the remainng portion a free hand to act. The management, of course, was not satisfied with this temporary solution of the problem, the pitting was traced to wrong gating and this was corrected. The gating had been analogous to that used on all other butts, but this particular pattern was unusually thin for its size and required special precautions in casting.

In another place manufacturing articles from antimonial lead and spelter, which are particularly liable to turn out porous, writer found an interesting method of dealing with the spotting out annoyance. The articles were copper- or brass-plated and then either just bright-dipped and lacquered, or oxidized, dried, and turned over to the buffers. The latter often spotted badly, the former never. The castings were not particularly selected for one or the other purpose. When bright-dipped, those pieces which were to be lacquered immediately were just rinsed in cold water, the water shaken off as much as possible, the remainder taken off in hot thinner and the articles left therein till thoroughly warmed, then immediately dipped in the cold lacquer and dried. It is not impossible that the acetone of the thinner, having a very strong attraction for water, claimed the moisture from the cavities, thus precipitating the salt and occupying the room made vacant by the absorbed moisture. In any case, the heat of the thinner caused a part of the enclosed fluid to extrude, thus making room for some lacquer to enter into the apertures deep enough, after cooling, to form an effective plug when dry and hard, preventing the enclosed fluid from doing further mischief. If we pour a solution of some salt, even diluted, into acetone, we see at once the salt crystallizing out, the acetone claiming the water from the solution, and this keeps on until the acetone is thoroughly saturated with water. Writer, however, can not recommend this method, as the vapors of the hot thinner, mixed with air, are liable to spontaneous ignition at any moment.

The boiling of spelter castings in a solution of red argols (crude cream of tartar) has also been found serviceable against spotting; usually, however, this method is combined with other precautionary measures, such as avoiding the use of boiling potash and other notoriously injurious solutions, and this may have part in the success of the treatment. The ready solubility of the spelter in almost any solution may also help in the success, the hot acid tartrate, or the solutions enclosed in the cavities, eating their way through the narrow inlets and thus facilitating the exchange of substances.

Treating brass, bronze, or iron castings in this way has been found less reliable, although the boiling tartar solution also attacks these metals and soon contains enough of the metals in solution to tarnish the articles. When pure cream of tartar is used, we can notice the blue copper color appear with the first charge treated therein. The writer attempted to keep the dissolving metals down by adding a little neutral soap to the tartar solution in order to precipitate the metals as insoluble soaps, thus preventing them from depositing upon the articles and tarnishing the same. The scheme worked inasmuch as no copper went into the solution, which remained colorless, and instead of tarnish, there appeared a bright film of metallic copper upon brass and brass-plated objects, the copper soap apparently reciprocating with the zinc in the brass.

In a plant which just had taken up the manufacture of art bronzes, such as inkstands, fancy trays, decorative wall plates, etc., writer occasionally observed peculiar cracks on some of the finished articles, while others of the same design were faultless. The caster was at once exonerated when the attention of the management was called to the defects. Examination of the alloy and the metals used in the foundry also gave no clue; the castings were faultless when they came from the foundry. A number of the same was secured, finished in the usual way, and closely inspected after each operation. Those pieces which were gold or silver-plated, or finished in statuary and similar fancy ways, stood every process they were subjected to, even quick changes from boiling solutions into cold water; sandblasted pieces invariably cracked in the acid dip, and pieces which were dipped without sandblasting could be made to crack alike when the acid dipping was repeated a few times. The cracks always occurred in identical places for each pattern, following the ornamentations. The castings were chilled, they withstood the mild action of the acid pickle and even the heat of light buffing, but the cutting down of the surface by the sandblast, or repeated acid dipping, together with the sudden superficial heat and corrosive action of the acid dip, released initial stresses in the metal. The man in charge of the foundry had come, with highest credentials, from a monumental bronze works, and he had not realized yet that thin and irregularly shaped fancy castings like those mentioned cool off and set at rates quite different from those of large and compact masses like a big monument.

When trying out the various new high speed nickel salts now in the market, the writer became curious to know how far the deposit could be forced on galvanoes without becoming too rough. Current was not available during the night, so the articles were taken out in the evening, rinsed, and placed in clean fresh water.

The deposit continued to come down smooth, almost bright and faultless to all appearances. It was found, however, that the daily deposits had failed to combine and could be peeled off separately when the edge was cut through. In doing so the writer chanced to hold one of the foils against the bright sunlight and was very much surprised to find it perforated by minute holes, and every section exhibited the same defect. Evolution of gas had not been noticed during the plating, although the current had been forced up to 18 amperes per square foot at times; and the solution appeared crystal clear, save for a slight sediment of the yellowish-green oxide or hydrate encountered in every nickel solution. The tank was carefully cleaned, the solution filtered through paper and operated under cover to keep out dust, except while under observation, and the experiment repeated. The white enamel walls of the tank and the bright white deposit favored the observation. No gas bubbles could be noticed upon the articles at any time, not even with the aid of a strong magnifying glass, so there was no "hydrogen pitting"; but fine particles of the same yellowish sediment, of which the solution had been so carefully freed, were soon seen floating about again in the solution, and they seemed to form right upon the work, for they often appeared suddenly upon a spot which was just under observation with the magnifying glass, and without that anything had been noticed before in the vicinity; though this may be an error, and they may have floated on in a position which made their detection difficult. In any case, they settled freely upon the articles, plain and buffed plates, suspended vertically in the solution and thus offering the least favorable condition for their attachment; and wherever such a particle had settled, deposition of metal ceased, and there soon had a minute hole formed; likewise, when a piece was taken out cautiously and examined under the magnifying glass, in every pithole such a little particle of sediment could be seen, but mostly floated off on rinsing. As already mentioned, the perforations are too small to impair the appearance of the plated articles, and as nickel is hardly subject to oxidation, they might be considered harmless; but where the nickel deposit only forms the foundation for a silver plate, it also furnishes the foundation for spotting for which then afterwards either the silver solution or porosity of the metal is blamed, "for nickel never spots."

The new individual oil blast furnaces, which give the moulder much more freedom of operation and thus hamper supervision, also seem to tend towards a marked decrease in the quality of the output, if not accompanied by an increase in the foundry staff. Cracked and pitted castings, full of blowholes, and with nests of dross, are now almost the rule, where formerly only the highest quality of output was known.

There are also external sources of spotting. Moisture may settle upon the stored articles, collect in drops, which absorb obnoxious fumes and gases from the atmosphere, that may attack the lacquer as well as the metal. Deposits from flies and mosquitoes decidedly do so, when left upon the metal for some time, and once decay has set in the origin of such spots is not always quite as easy to establish as might be surmised. Analyzing the wrapping paper used in one plant at regular intervals for several years, the writer at first found considerable amounts of free acid in the sheets and also nests of mineral fillers which had not been evenly distributed in the pulp. While the latter is naturally of an inert character, else it would destroy the fiber, yet it is highly hygroscopical and may not only attract the free acid from the surrounding sections and concentrate it upon the metal, but also atmospheric moisture and the fumes it carries. The trouble ceased after a few consignments of such paper had been returned and the manufacturer had realized that his product was not accepted at face value.

Sometimes the spots result from blisters in the deposit enclosing destructive solutions. Whether they spot out or not, blisters can not be tolerated in the deposit, and the plater will take care of this particular case himself.

In the majority of cases, the spotting originates from cracks and little cavities hidden below the surface and communicating with it by infinitely small channels, which makes their detection difficult. Open blowholes, or apertures enlarging outward, make no trouble; they can as easily be cleaned out as steep and narrow crevices of ornamental castings; but hair-fine channels, cracks, or pinholes, retain the solution therein by capillary force, thus blocking the communication with the contents of internal cysts, and do not respond to ordinary washing. The writer tried to play osmotic force against capillary, as through a diaphragm, and thus dislodge the contents of the cavities; but whether the curing liquid was used hot or cold, strong or weak, no progress was noticeable, even after days of immercion. The atmospheric pressure in this case is one-sided and favors capillary retention. The only way to move, and finally remove, such unwelcome tenants is by atmospheric pressure, which even controls the limits of (vertical) capillary attraction, and relying upon the difference of expansion between liquids and solids; but as we can only make use of this *difference* of expansion, it is self-evident that we can only accomplish a partial substitution of a new solution at a time, not a complete exchange by a single plunge or a single boiling in a curing solution; and the way this exchange takes place is directly the reverse to the generally accepted theory. This fatal error is largely responsible for the many failures in the attempts to prevent or cure spotting. All the authors thus far heard on the subject expand the pores of the metal by heating it in some boiling liquid. This is correct; but they are entirely wrong when they add: "Thus making room in the enlarged cavities for some of the boiling water, or solution, to enter and mix with the retained substance." Their further contention: "Then by a sudden plunge into ice-cold water, we contract the surface of the metal and squeeze out (part of) the mixture" is simply absurd. First of all, they forget the resistance of the enclosed masses of metal against compression. Make water freeze in a sealed bomb, and the expanding ice will burst the strongest steel walls just as it splits rocks; or heat it, and the steam will do the same with irresistible force. If matters would take this course with metal, brass and bronze foundries would not have to search far for an excuse for "season cracking." Glass is a poor conductor for heat, and there we can accomplish a "sudden superficial contraction" before the interior has time to cool off; try it and see what follows! Metals convey the changes of temperature immediately into the interior, and when the piece is compact, with a comparatively small receiving surface, the rise or fall of temperature in the article, surface and interior alike, will merely go on slower than in a thin shell with a large surface of contact. This, however, is not even the worst feature of the error. What all the gentlemen strangely forget is, that the contents of the cavities also expand, liquids more than solids, and gases most of all. (To be continued.)

FOUNDRY PROBLEMS

An Article Dealing with Questions Incidental to the Successful Melting of Metals.

By W. J. Reardon.*

I have been requested by a number of brass foundrymen to write an article on the melting of metal, and at this time when the crucible situation is up in the air, I decided to give this matter some close personal study with a view of finding a method that would be independent of the use of crucibles. One of the most difficult problems the brass foundry has to deal with today is the melting of metal, and as this end of the foundry is equally if not more important than any other, it is essential that we reduce the trouble to a minimum both for the benefit of the product of the foundry and for the physical well-being of the man in charge.

As most foundries use crucibles for melting, we had best look into this line of supply. As all foundries are aware of the fact that the crucible situation is a trying one at the present time, first it is a hard matter to get them and when you do, you find that you are only able to procure about one-half the number of heats that you formerly got and then coupling this situation with the fact that the price of crucibles has advanced, you find that your cost for crucibles has increased over 100 per cent. due to the fact that you must use double the number of crucibles you formerly used for the same output of metal.

Cases have come to my notice recently where from thirty to forty heats were formerly obtained from a crucible, but at the present time much satisfaction is felt if from fifteen to eighteen heats are obtained; then again taking into consideration the kind of metal melted I find where the average heat per crucible was fifteen, two heats are now the average.

The cause of all the trouble evidently is credited to the fact that the crucible manufacturers claim that they cannot secure German clay and are forced to use domestic clay, and last, but not least, the price has been raised a couple of cents per number. The manufacturers of crucibles, upon learning the facts from the foundry, will tell you that they do not understand the situation and that you must be careful in the annealing, which practice does not improve the situation in so far as you are concerned. As a matter of explanation I would state that I am not finding fault with the crucible manufacturers, as I have not the slightest doubt but that they are doing the best they possibly can under the existing circumstances, as the following circular which I received will prove and which explains as follows:

"We can only say that during these strenuous war times we have had to use the best materials we could possibly obtain, and we have sent out letters, of which you have had a copy, saying that we could not be responsible for the performance of our product, or, to express it in a little different way, you would have to take them as you did your wife—'for better or for worse.' (This has always been the custom of the United States, although we believe there are some countries where you can trade her off if she is not satisfactory.) We have always been extremely liberal in regard to making what we call 'fix-ups' in case a customer was not satisfied with our crucibles, and if you feel like condemning us under the present war conditions, will you not please give us credit at the same time for our generosity in the past? We feel sure that when you look at the matter in the above light you will have patience with us for a little while longer, because our experiments not only in the laboratory, but also in actual practice (we have been running a brass foundry of twelve fires for a year and a half to give us actual furnace conditions), lead us to believe that we have struck the right kind of domestic clay and it will not be long until we can furnish you with as good crucibles as we have ever done in the past with foreign materials."

However, the vital point is, with the trouble experienced with the use of crucibles is there not some other method of melting brass, and the answer is yes, positively and surely yes.

The foundries have been experimenting with various kinds of furnaces other than crucibles for the past fifteen years and what has been the result? Very unfortunately it must be admitted that very few foundries have made a success of the open flame furnace and the trade wonders why. Well, it can be explained as follows: Unfortunately for the brass foundries and the inventor, this style of furnace fell to a party of individuals who knew very little of brass foundry practice, and as a consequence would not be successful when they would try to market and install the furnace—in fact, all they were really interested in was to sell the furnace and get the money and then let the foundry work out its own salvation. One result was that the furnace was never fully developed as a general proposition. However, this was not the case with every foundry where an installation of this furnace was made, as in some cases with which the writer is thoroughly familiar the furnace was developed at the expense of the individual brass foundry. Unlimited experiments were made to secure a perfect combustion and a reducing atmosphere in the furnace which is known to the trade as the Schwartz Open Flame furnace. This furnace when properly constructed, I believe, has many advantages over any style furnace, barring none, and when operated in the right manner is, I think, the best one for brass foundry work. It has the advantage over any other furnace of melting with less fuel, lower cost of melting, less loss of metal, cost of repairs are less and will melt in large or small quantities with very little variation in the per cent. of fuel consumed.

When the strength of the metal is of great importance this style of furnace is to be preferred when actual results are all summed up and satisfactory results are the ones which count. I have been running this style of furnace for the last fifteen years and my experience has been that, for classes of work where the castings are required to meet certain specifications, such as tensile strength, elongation and analysis, this style of furnace has proven far superior to the crucible furnaces, not only regarding these qualities, but also as to the cost of melting and its ability to produce the goods when properly handled.

I have in mind a number of tests made recently on a Government bronze of fifty heats. Each casting was cast with a coupon and stamped by a Government Inspector. One or more tests were made from each heat for analysis and physical test. The following specification to be met in the analysis test:

	Per Cent.
Copper not less than	87.00
Tin not less than	8.00
Zinc not over	4.00
Lead not more than	.50
Phosphor not more than	.05

while the physical test was

Tensile not less than 30,000 pounds per square inch
Elongation not less than 15 per cent.

The average result of the physical tests made was ten-

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sile 40,000 pounds and 35 per cent. elongation, and some of these tests ran as high as 48,000 pounds tensile. Only one heat was rejected and this heat was made in a crucible furnace, the test showing 28,500 pounds tensile and 12 per cent. elongation. This was convincing proof of the inferior quality of metal produced from a crucible furnace as compared with an open flame furnace, and I was not long in deciding that this result was all I could expect from a crucible running a mixture of this kind and the remaining forty-nine heats running from 500 to 1,000 pounds per heat were run in the Schwartz furnace without having one rejected, a very gratifying result, I am sure.

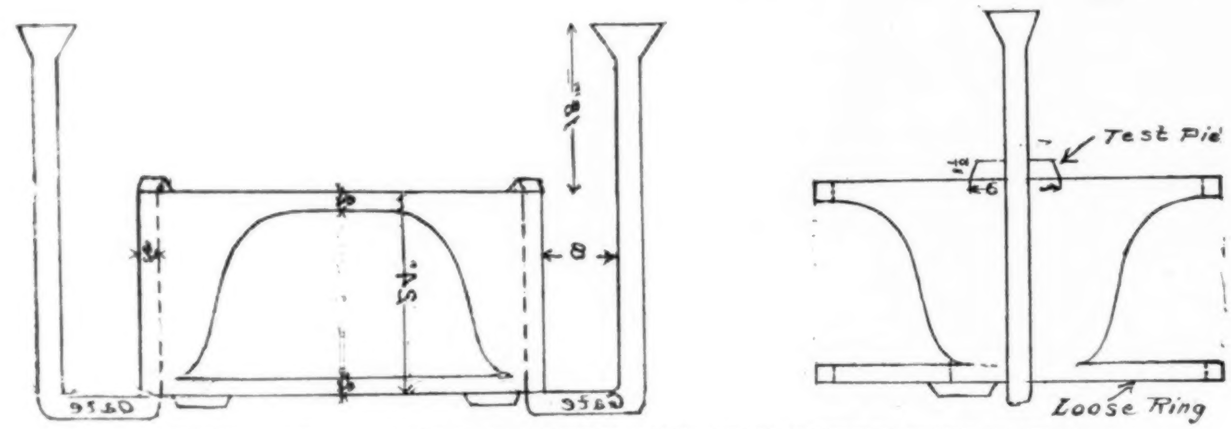

PLATE 1. FIG. 1.—DETAILS OF CASTINGS MADE FROM MIXTURES GIVEN IN TEXT.

Every heat ran far in excess of the requirements, the average analysis running very close to the specifications, as the following will show. Mixture used:

Copper	87
Tin	8
Zinc	5
Lead	½
15 per cent. R. Phos. copper	2 ounces

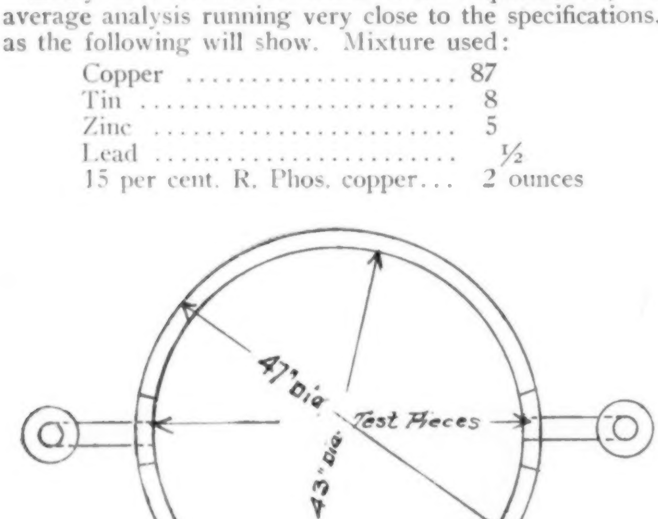

PLATE 1. FIG. 2.—A PLAN VIEW OF CASTING SHOWN IN FIG. 1.

while the analysis of the metal after melting and casting showed as follows:

Copper	86.75
Tin	8.45
Zinc	4.32
Lead	.50

Plate 1, Figs. 1 and 2.—Show a cut of one of the castings made from the mixes previously mentioned. Note the test bars, also the fact that no risers were used in this casting. The weight of this casting in the rough was 1,500 pounds.

Plate 2.—Shows a casting made from one of the forty-nine heats and cast without riser and made in a similar manner as the casting shown in Fig. 1.

A number of copper castings cast from copper melted in the Schwartz furnace run as high as 96 per cent. conductivity from tests made by our Engineering Department. The results of these tests should be convincing proof of the perfect melting that can be accomplished in this style of furnace when operated in the proper manner. I might state at this point that I have no interest whatsoever in any furnace, and my whole intention is to prove to the brass foundry that metal can be melted successfully and with efficient results in the open flame furnace if

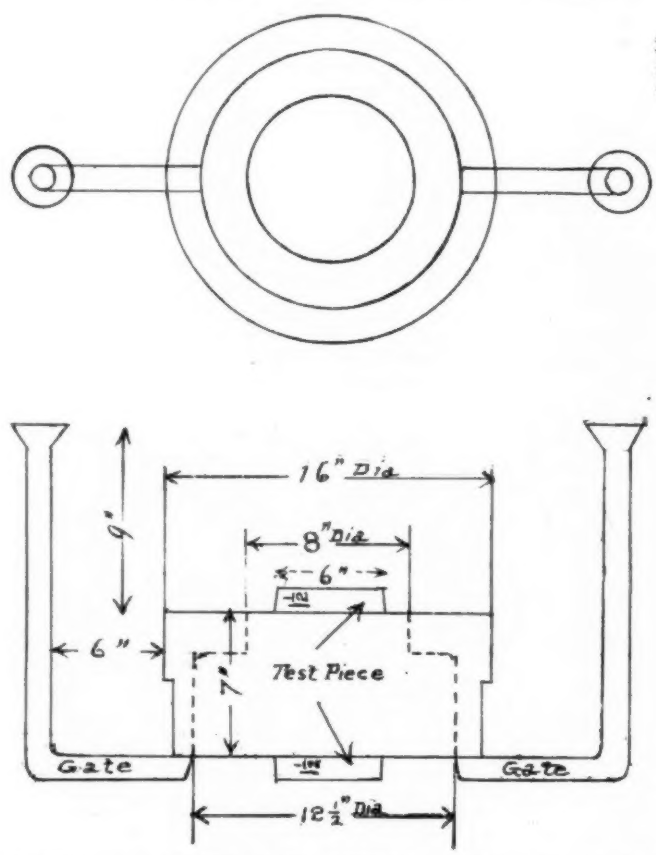

PLATE 2. A CASTING MADE WITHOUT RISER AND IN THE SAME MANNER AS IN FIG. 1.

same is operated in the proper manner. This statement covers all classes of work, with the exception of yellow brass running approximately 60 per cent copper and 40 per cent zinc, which the pouring from the furnace to the

ladle lowers the temperature of so as to cause the metal to become too cold for light or intricate work such as chandelier castings.

Fig. 3.—shows a quantity of magnalium castings

FIG. 3. A LOT OF MAGNALIUM CASTINGS, 93 ALUMINUM AND 7 MAGNESIUM.

made from a mixture of 93 alum, 7 magnesium. These castings are used in ignition, lighting and starting apparatus.

Fig. 4.—Shows a quantity of aluminum zinc castings made from a mixture of 66 2-3 aluminum and 33 1-3 zinc and cast from metal melted in the Schwartz furnace.

Fig. 5.—General view of a miscellaneous quantity of castings, all cast from metal melted in a Schwartz furnace.

I am firmly convinced that many will take exception to the previous statements and the ones following, when you consider the prejudiced feeling existing among the brass foundries of the present day. As proof of this assertion you have to but realize the fact that the brass mills in the East (in spite of pronounced advancement in all

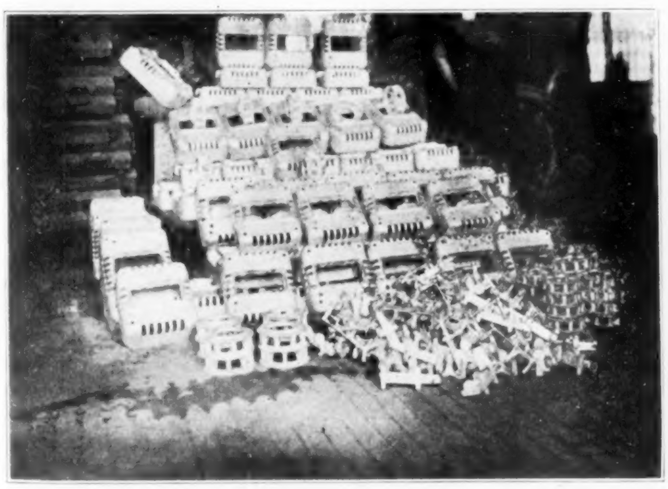

FIG. 4. A QUANTITY OF ALUMINUM ZINC CASTINGS, MADE IN SCHWARTZ FURNACE.

lines of manufacture) are employing the same methods of melting and pouring brass as they did fifty years ago, and I have been advised that any one that has ever attempted to revise or change this method of melting never lasted long enough to get properly started.

I would compare the melting of brass in the foundry to-day to the molding machine thirty years ago. I can well remember when they were first introduced and the many failures, all due to the prejudice against them, and it was a hard and costly struggle to convince the foundry that castings could be molded by power ramming machines and produce castings that no molder could duplicate, no matter how great his skill was in this line of work.

When you consider the vast amount of money and hard labor that can be saved in the foundry by adopting modern methods of melting brass, I often wonder why our American Institute of Metals does not take up this question. Spend some of their money installing the different styles of furnaces and at the same time employ the best talent obtainable to test these different methods of melting for loss in melting, cost of operating and quality of the metal produced. Then I believe they would be doing something of vast importance to the brass foundry industry. I would suggest that the idea be brought up at the next convention of the American Institute of Metals at Cleveland, Ohio.

Another point of very great interest at this time is the melting of aluminum in the open flame furnace. To obtain perfect results the tuyeres must be placed properly

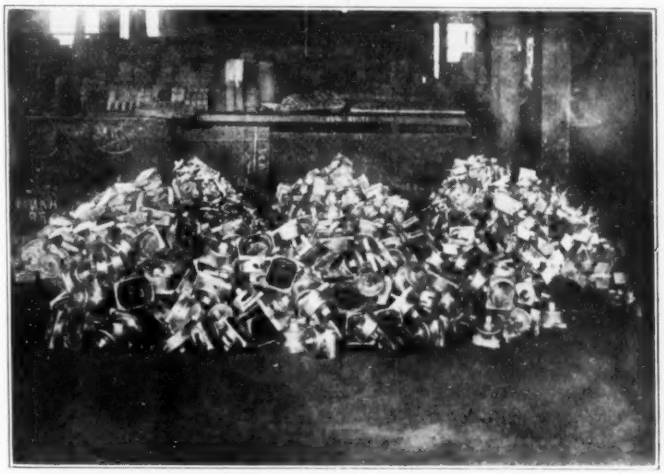

FIG. 5. GENERAL VIEW OF A MISCELLANEOUS LOT OF CASTINGS MADE IN A SCHWARTZ FURNACE.

and the combustion perfect, and you will find that this method is far superior to all other methods of melting aluminum. After a few heats have been taken out of the furnace the lining becomes coated with aluumina and no further silica is taken up. A good way to avoid this situation is to first melt some turnings, then pour in ingots and add a small amount to each future heat. By following this method you get a better metal free from iron and silica.

As an example of the superior quality of metal when melted in an open flame furnace as compared to metal melted in a crucible we will take No. 12 aluminum, which I believe is a standard mixture running about 93 per cent aluminum and 7 per cent copper, or 92 per cent aluminum and 8 per cent copper. This mixture, when cast from a crucible, will run approximately 18,000 pounds tensile and in many cases less than 18,000, while if cast from the same mixture melted in the Schwartz furnace it will run from 21,000 to 25,000 pounds tensile net, 9,000 to 12,000 yield per cent 4,000 to 7,000 elastic limit, 2 to 4 per cent elongation and 3 to 6 per cent reduction of area.

Another mixture that will give excellent results when melted in the open flame furnace is 93 per cent to 95 per cent aluminum and 5 to 7 per cent magnesium. The result of a test will show as follows: 25,000 to 30,000 pounds tensile, 10,000 to 15,000 yield point, 5,000 to 10,000

elastic limit, 5 to 10 per cent elongation and 8 to 15 per cent reduction.

The above are actual facts and not based on theoretical findings, but rather upon actual experience from daily practice and can be proven by the fact of records from tests made by a Government Inspector of castings cast under his personal supervision for a period of five months. For quality of metal and castings, I believe I am safe in venturing the assertion that very few, if any of us, realize at this time the great future in store for aluminum castings. I noticed in the February issue of *Gas Energy* a very interesting article on aluminum alloys by the well-known engineer, Henry Sturmey, who says in part as follows:

"Aluminum alloys have now been produced which are able to give satisfactory service both for engine cylinder pistons and connecting rods, so far as the first application is concerned. It is something to find that it is possible to produce an aluminum alloy which will not only withstand the heat generated by combustion, but also withstand the expansion which follows the pouring of the charge. It has further been shown that aluminum can resist the tendency to crystallize under constantly repeated shocks of the explosion, and so far as friction of the piston is concerned that appears to be effectively met by shrinking in a thin steel liner. Now, there are more in this successful use of aluminum alloys for cylinder castings than meets the eye at first glance. It is not only the saving in weight that is gained, but there is very much more in it than that, and I look at it as a possibility that it may create a revolution in car design, even of the commercial vehicles. There is the high conductivity of aluminum, as compared with cast iron; and, that being so, I see the possibility of arriving at success with air cooling, which would do away at once with radiator, pump, water jackets and connection, and effect a substantial saving in weight, first cost complications and upkeep expenditures. This development should be watched on this account, and what a future there would be for an alloy similar to the above aluminum and magnesium alloy."

The Western Electric & Manufacturing Co. have been using this mixture of aluminum and magnesium in all their ignition lighting and starting apparatus on account of the extreme lightness, high tensile strength, elongation, durability and ability to withstand shock and electrolysis. Its superiority over all aluminum alloys known to-day is above question, notwithstanding the very high cost due to the present war (as magnesium has all been made in Germany); nevertheless, regardless of obstacles that may seem nearly impossible to overcome, the Westinghouse Electric & Manufacturing Co. stands for quality first, last and all the time.

LUBRICANTS FOR METALS

The Uses and Values of Oils in a Metal and Brass Working Plant.

By P. W. Blair.*

Within the past ten years lubricating oils have been an important factor in metal and brass working plants throughout the country. Owing to the strict fire insurance laws governing the amounts of oils that can be carried in buildings, it has necessitated the erecting of separate oil storage buildings where the necessary amounts can be carried, from the crude product used for melting purposes and pumped to the furnaces, to the high grade mineral and vegetable oils used for lubricating and machining purposes.

The value of an oil as a lubricant depends upon its film-forming capacity, that is, its capability of maintaining a film of oil between the bearing surfaces. The film forming capacity depends to a large extent on the viscosity of the oil, but this should not be understood to mean that the oil of the highest viscosity is in every case the most suitable lubricant. On the other hand, an oil of the lowest viscosity which will retain an unbroken oil film between the bearing surfaces is the most suitable for purposes of lubrication, because a higher viscosity than that necessary to retain the oil film results in a waste of power due to the expenditure of energy necessary to overcome the internal friction of the oil itself. For internal lubrication only mineral oil of good quality should be used. Vegetable or animal oils are unsuitable owing to the fact that they decompose at high temperatures forming acids which are injurious to metals. It is of importance to note that the following oils have a tendency to corrode the metals mentioned: tallow, seal and rape oils, copper; whale and lard oils, lead; sperm oil, lead and zinc; and cottonseed oil, tin.

Lard oil as a lubricant for machining brass is extensively used on hand and automatic screw machines, as the stock used on these machines are rod and tube work, and as the machines are run at a high speed it also acts as a cooling substance, as well as a lubricant. Cast brass is machined dry. A mixture of lard oil and turpentine is used for machining copper.

One of the best lubricants for machining aluminum is a mixture of kerosene and gasoline. There are a number of lubricants which are cheaper than oils and are extensively used on metals in machining operations. These are composed of a mixture of sal-soda and water to which is added some such ingredient as lard oil or soft soap to thicken or give body to the lubricant. A good cutting lubricant consists of equal parts of so-called electric cutting oil and paraffin oil. One of the best lubricants for machining operations is paraffin oil without being mixed with any other ingredient. It is not as expensive as the other lubricants and has proven most satisfactory. Lard oil as a cutting lubricant after being used for a considerable time seems to lose some of its good qualities as a cooling compound. There are several reasons for this. Some manufacturers use the same oil over and over again on different materials, such as yellow and red brass rod, etc. This is objectionable, for when lard oil has been used on yellow brass rod it is practically impossible to get the fine dust separated from it in a centrifugal separator.

When this impure oil is used on red brass it does not give satisfactory results, owing to the fact that when the cutting tools begin to lose their sharp edge the small particles begin to freeze to the cutting edges and thus produce rough work. If the oil is always used on the same class of material it will not lose any of its good qualities.

Prime lard oil is nearly colorless, having a pale yellow or greenish tinge. The solidifying point and other characteristics of the oil depend upon the temperature at which it was expressed, winter pressed lard oil containing less solid constituents of the lard than that expressed in warm weather. The specific gravity should not exceed 0.916; it is sometimes increased by adulterants such as cottonseed and fish oils. Lard oil used on brass tubing and iron pipe size brass pipe when threads are cut cannot be equaled. As in a majority of cases the tubes are annealed or semi-annealed and soft and tough the lard oil allows clean threads to be cut.

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The adulteration of oils and range in prices varies so considerably that at some time or other manufacturers have on hand a supply of adulterated oils or poor grades. Nearly all commercial oils are obtained from petroleum. Mineral oils are classed commercially as "pale and dark." The pale oils are somewhat transparent and are tinged with a variety of yellow and red shades. The dark oils are opaque and are either greenish or brownish black. The specific gravity of mineral oils usually varies from about 0.860 to 0.940 and the flashing point from 300 to 600 degrees Fahrenheit. The oils obtained from petroleum have a much wider range of viscosity than the fixed oils. Fixed oils are so named because they are not volatile without decomposition. They are obtained from the seeds of fruits or plants and the tissues of animals. Sperm oil has the lowest viscosity and castor oil the highest.

The most common lubricants among animal oils are tallow, lard, neats' foot and sperm oil, and among vegetable oils rape, olive and castor oil. There is a rosin oil which is obtained from common rosin by distillation and is not suitable for the lubrication of machinery, but is used to adulterate mineral and other lubricating oils. Some mineral oils are adulterated or thickened artificially to give them body by the addition of a substance such as aluminum soap. This increases the viscosity, but the latter rapidly diminishes when the oil is heated. Mineral oils are also thickened with sufficient soap such as lime, soda or lead soap to form a grease at ordinary temperatures. These greases may also contain some solid lubricant such as graphite, talc, etc.

Many of the more expensive oils such as sperm, olive and lard are adulterated with cheaper fixed and mineral oils. Cottonseed is often mixed with lard and olive oils and is substituted for the latter. The use of adulterants in order to increase the viscosity is usually resorted to in the case of mineral oils. The presence of these adulterants can sometimes be detected by comparatively simple tests.

The quality and properties of some lubricating oils can be determined approximately without the use of special testing apparatus by the following simple methods: To determine the presence of solid impurities in the oil kerosene is added to half a tumbler of oil until the whole becomes quite thin. The mixture is then passed through filter or ordinary white blotting paper and after the oil has passed through the paper is washed with kerosene the residue on the paper will show if the oil had any solid impurities. Impurities may also be detected by smearing a piece of writing paper with oil and holding it against the light; if the oil is free from solid impurities the blot will be equally transparent throughout—otherwise the solid particles will show.

The pure oil must not "resinify": To test it in this respect pour into a shallow dish and leave in a warm place for about a week. There must not be the slightest crust at the end of that time. Another way to test oil is by mixing it with fumes of nitric acid. If the oil is pure a thick mass will form in a few hours, while a "resinifying" oil will remain thin.

Acids are very injurious impurities in lubricating oils, since in time they attack the machine parts or materials lubricated. To test for acids, copper oxide or copper ash is added to the oil in a glass vessel, acid-free oil retains its original color, while if it contains acid it becomes greenish or bluish. Another simple test is to drop the oil on a sheet of copper or brass and leave it there for a week. If the oil contains acid there will be a green spot on the metal. A good oil must be greasy in order to have good lubricating qualities to determine which of several oils is best in this respect place a few drops of the different oils on a smooth, slightly inclined metal or glass sheet the drop of the best oil will travel furthest in a given time. Cylinder oil may be tested by heating and noting its color. A good cylinder oil will not change color to any noticeable degree when heated to 480 degrees F., or to a temperature higher than that existing in a high-pressure engine cylinder. Low grade oils, however, will darken when heated to this temperature. Another method of testing cylinder oils which gives good results is as follows: Heat the oil in a current of air for one hour at a temperature corresponding to that of the required steam pressure. The loss in weight should not exceed 0.5 per cent.

Lubricants for press work dies are often run without lubrication, but they will last longer if oiled slightly. The oils most commonly used when punching iron, steel, copper or brass is lard or sperm oil. For working brass or copper under the press a solution of 15 pounds of Fuller's earth soap to a barrel of water used hot or any solution strong enough in potash is cheaper and cleaner than oil. The stock should pass through a tank filled with this solution before entering the dies. For many classes of die work no lubricant is required, especially when the metal is of a greasy nature like tin plate, for instance.

Oil baths are extensively used for tempering tools used in the manufacture of metals, as a temperature of from 650 to 700 degrees F. can be obtained with heavy tempering oils.

A tempering oil which has given satisfactory results in practice has the following characteristics: Composition mineral oil, 94 per cent.; saponifiable oil, 6 per cent.; specific gravity, 0.950; flash point, 475 degrees F.; fire test, 550 degrees F.

The thicker and less free flowing an oil is the greater the unit pressure it will stand in a bearing without squeezing out. A watch oil or a light spindle oil can only be used under a very slight unit pressure. A cylinder oil of good quality will stand a pressure of over 200 pounds per square inch in the same bearing where the watch or light spindle oil will stand only 50 pounds.

It is therefore possible to determine and it is important in each case to do so, what quality of oil is best adapted to each particular use and in place of using an oil costing 50 cents per gallon, an oil costing 20 cents per gallon may perform the work in a more satisfactory manner.

BRONZE IN TORPEDOES.

According to a report published in the New York Times for March 2, 1916, a piece of metal scrap found in the life-boat of the steamship Tubantia recently sunk, may prove a valuable clue to the cause of the disaster. This piece of metal was of bronze, shaped like the letter "S" and its dimensions were 250 millimeters long, 83 millimeters wide and 5½ millimeters thick. The report issued by the Ministry of Marine of Holland as to the results of test made at the torpedo shops at Amsterdam states that "it showed high tensile strength," says the statement, "introducing the belief—and also judging by its shape and color—that it belonged to the air chamber of a torpedo. The origin of seventeen other smaller pieces of metal found is uncertain."

THE ART OF ENGRAVING AND EMBOSSING

An Exhaustive Article Dealing with the Production of Artistic Effects in Metal Work.

By Easy Way.

The art of incised and beaten-up metal work has always been very popular and is one of the oldest arts in existence and can be traced back to B. C., of which there are specimen relics of Oriental design and known as Cairene work. This class of work involves less labor than incised work and it is a curious but a known fact that a youth who has served a time at beaten-up work (if he possesses ordinary application) can learn to engrave proficiently afterwards and with proper time for practice will be able to hold his own with any follower at the art of engraving. On the other hand an engraver can not properly produce a beaten-up article, because the knack of treating the metals must always be acquired in youth or it will never be thoroughly mastered later on.

That this truth may be made more clearly understood, let us cite a marble carver, who so cleverly creates images in stone or marble, but let him try his hand at carving wood into the same identical figures and the result of his endeavor is torn, rather than cut wood, and he finds he cannot do it properly even though supplied with the proper tools. Some of the most successful metal engravers began their careers as beaters because a thorough knowledge of metals and the use of tools is half of the profession itself and the step from the ornamental metal beater to the engraver is comparatively an easy one, more particularly in the matter of designs. The engraving art, which consists in the execution of designs by incision upon plates of metal such as copper, gold, silver, etc., as an ornamental surface decoration was also used at the beginning of the age of printing.

FIG. 1. BRASS STAMP AT BRITISH MUSEUM.

There were Israelite engravers, who are referred to in the Holy Scripture, that practiced the art of engraving on metals while in captivity in Egypt and devised and created all manner of cunning work with the graver. Also the Greeks devised maps on metal plates on which was inscribed every part of the habitable world together with the rivers and seas at an early date B. C. There are now on exhibition in the coffins of mummies at the British Museum, London, England, very rich and ancient specimens of the Egyptian art all extant and very well guarded within glass cases and carefully watched by trusty officers.

Should the readers peruse the forty chapters of Exodus, the Second Book in the Old Testament, they will find very interesting articles on ornamental gold, silver, brass, etc., and which distinctly reads that the Israelites practiced the art of metal engraving. When Moses liberated these people from the Egyptian bondage he was commanded to make a plate of pure gold and on it engrave "Holiness to the Lord."

But the curious fact is, after all the past years of inventions and improvements, the tools of the engraver today remain practically the same as his ancestors in the days previous to the writing of Exodus, because the lines cut by those artisans were produced with the lozenge graver, and to this day it is chiefly used together with the other style of gravers and modernly termed the scoopers and scorpers for cutting broad lines and lines of the same width throughout. There is also recorded in the book of Exodus articles produced from beaten gold and on them characters engraved. Also precious woods were overlayed with gold, the wood used being a species of Acacia called Shittim wood which was very hard, tough, smooth and finished up very beautifully.

Pure gold was beaten into articles such as spoons, dishes, bowls and their covers, lamps, snuff dishes, crowns, candlesticks, and mercy-seats with cherubins on them and their wings outstretched as a canopy covering the mercy-seat. The candlesticks were produced very artistically and about the columns or shafts were branches of gold from which flowers of gold were suspended. The bowls of the candlestick represented almonds and this was of beaten-up work of pure gold. Also an altar of burned offering was produced from Shittim wood and trimmed with horns overlayed with brass and its vessels, pans, shovels, basins and flesh-hooks for the altar were made of beaten brass and surrounding it was a net work of brass suspended by four brazen rings.

The fifty pillars and their sockets for the Court of the tabernacle around the altar were of brass, the hooks of the pillars and their fillets were silver and all the pillars were filleted with silver and created as a statue

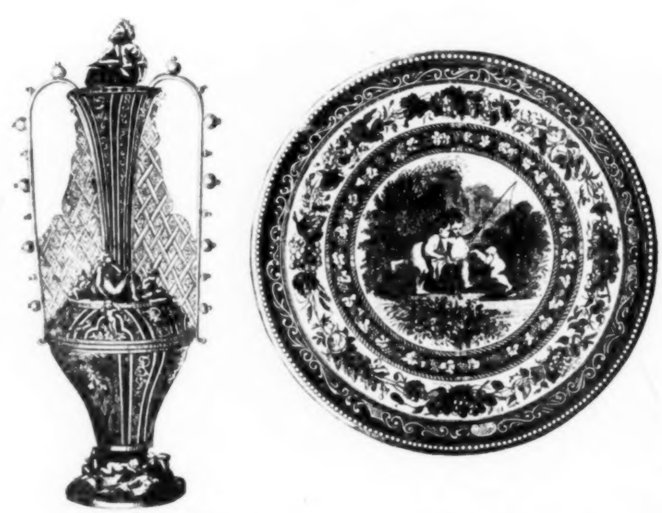


FIG. 2. EXAMPLES OF WORK DONE IN NIELLO.

on behalf of the children of Israel and a testimonial unto the generations to follow their completement in the year 1491 B. C. There are excellent specimens of metal work produced by the Egyptians and the Anglo-Saxon race preserved in the British Museum and Ashmolean Museum at Oxford of inscriptions on monumental brasses, grotesque figures of gold with rock-crystal and enamelled mosaic sunk into it representing the heads of sea monsters and others which are the likeness of men and effigies. Also a splendid collection of gold snuff-dishes and boxes ornamented with priceless jewels, all of which

are of the highest possible interest inasmuch as they show the skill of our ancestors.

Gold, silver and brass were evidently the first metals to be used for the purpose of images and inscriptions until copper plate was introduced for printing and illustrating, and copper was used until movable metal type was substituted, which will be described later. The art of engraving for printing had its origin in the workshops of goldsmiths. The characters, after being engraved on the plates, were filled in with a black composition composed of silver, copper, lead, borax and sulphur, and due to its dark color was termed niello and was discovered as a result of an accident. It was usual with the workers to rub charcoal and oil into the design engraved on the plate so as to ascertain the effect before filling it in with the niello, and on one occasion, after rubbing in

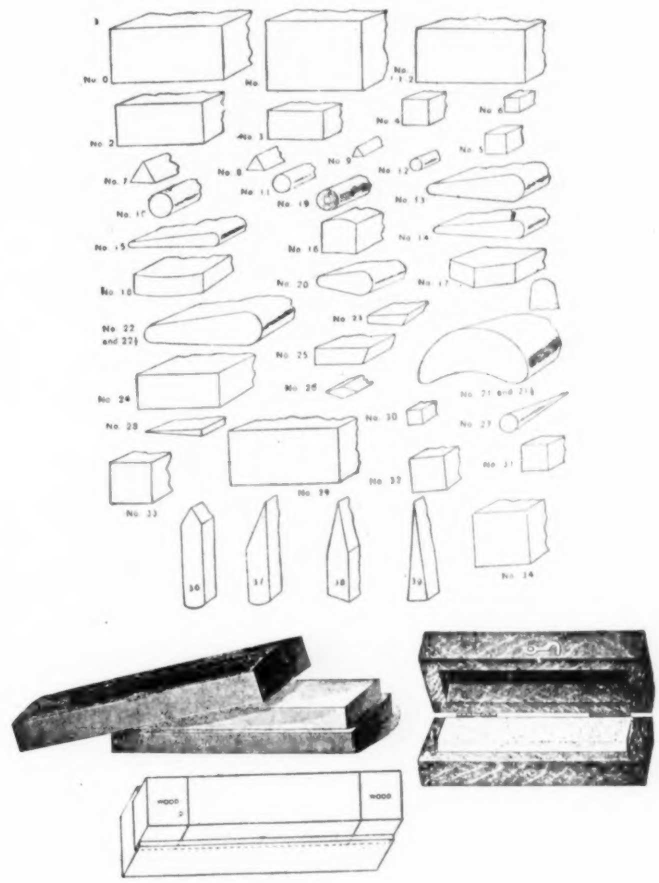
FIG. 3. HAMMER HEADS AND ENGRAVING TOOLS.

the oil and charcoal, some melted sulphur accidentally dropped in it on the plate, and upon being removed brought with it the mixture out of the hollows and showed an exact impression of the work and thus was found the art of printing.

The method of producing works in niello is nothing other than designs made upon the metal the same as if painted with a brush and was discovered by the goldsmiths. The method of producing work of this character is to design the proposed subject with a pointed steel tool and make an even smooth surface, then engrave it with the graver. When finished a mixture of silver, copper, lead, borax and sulphur is made up into a composition over a fire and let cool, when cold this mixture becomes very brittle, but when melted it is of such a nature that it will flow nicely into the hollows of the work. To prepare this composition for the work it is first pulverized very finely and sprinkled upon the engraved plate, which should be thoroughly cleaned.

The plate is then warmed sufficiently to dissolve the niello and cause it to flow into all of the engraved parts. Then when the plate becomes cold the niello is rubbed away by pumice stone and finished with leather until the true design appears even with the metal, after which the whole surface is polished and a beautiful species of handicraft is the result.

A more recent method of engraving copper for print-



OIL STONES AND MOUNTS.

ing was by indenting the surface of the plate all over with a toothed edge cradle or grounder (a tool the style of a chisel). This cradle being rocked over the entire surface of the plate roughens its surface so that it will hold ink. After this has been accomplished, the artist, with scrapers and burnishers, removes the ground from the plate wherever he wishes the white spots of the design and the more ground removed the less ink will reach it and in this manner a picture is built by cutting in the lights only, instead of cutting in the shadows as when ordinarily engraving.

The art of engraving by corrosion was discovered almost unconsciously by a soldier while on the battlefield. One morning he was cleaning his firearm and after removing the rust spots occasioned by the moisture of the evening previous, he perceived a resemblance of characters in the metal and the thought occurred if a plate was corroded all over its surface a design could be produced by scrapers from which impressions could be taken. There are some very rare specimens of this art in the British Museum of copper and wood. The dif-

ference between engraving on copper and wood is that with copper the design is sunk into the plate by cut lines, while with wood engraving it is cut in relief or raised lines and the advantage of this over copper is that the wood cuts may be printed along with the type, being in relief, while with copper plates it necessitates printing separately. The photo-mechanical process has almost superseded this art, where previous to its discovery all high-class printing was produced by the copper method just explained.

Engraving on brass is accomplished with chisels and a hammer or mallet when producing heavy work as ornamental escutcheon plates, metal memorials and signs, and to this day the routing machine, used so extensively in America for this class of work, does not supplant the

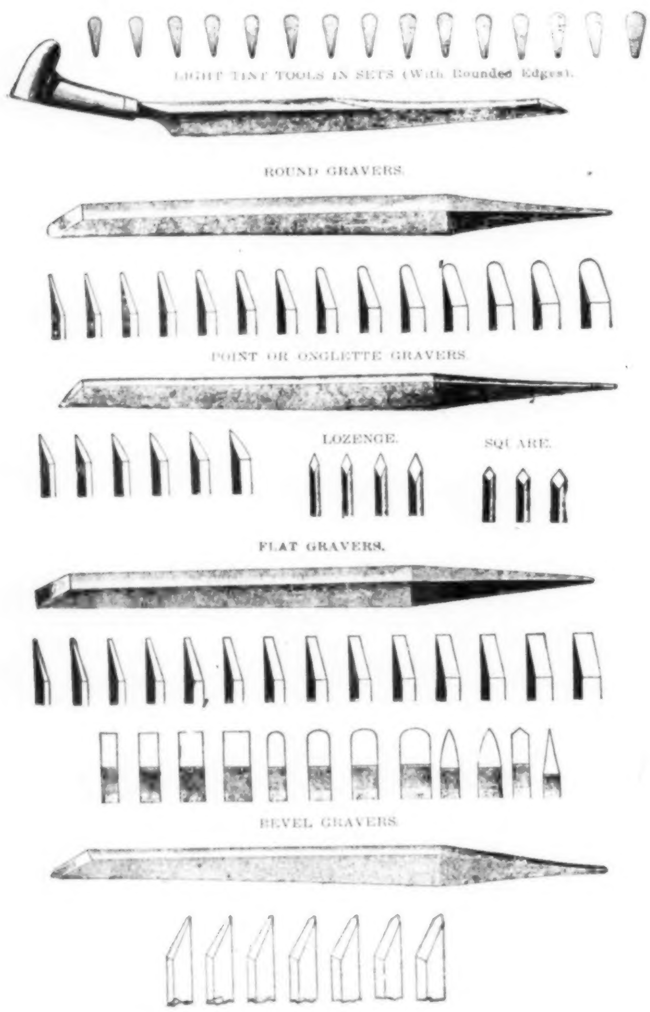


FIG. 5—AN ASSORTMENT OF ENGRAVERS TOOLS

hand work method abroad. The workman can be seen whacking away blow after blow and it is really a slow method, often taking hours and days, according to the design; whereas with a machine router, the spindle revolving a tool upwards of thirty thousand revolutions per minute it is very evident that the same job can be produced in one-tenth the time. Engraved or incised work is accomplished on all metals precisely the same way, the only difference being the tools are hardened and tempered to suit the nature of metal to be worked. Embossed or repoussé work is the art of raising the metal from the back to produce designs. The metal may be flat or otherwise and of any shape imaginable. The ancients produced articles by hand with the aid of punches and shaped hammers, but with the advent of power presses and dies a large percentage of the work formerly hand hammered is stamped by machinery. Embosed work has always occupied an important place in artistic wares and was produced by famous artists of olden times by handicraft, while the modern way of production is to prepare a die and the same class of work can be produced at one-tenth the cost and in large quantities and be an exact duplicate.

For many years this class of work was guarded against cowans and evadors and quite a secret. Even the tools for producing could not be purchased and if a number of articles were wanted by a customer the contractor would supply them, but the tools remained and could not even be seen by the customer, just the same as the molds for die cast parts and other work of that class are withheld at the present time.

The articles to which embossed work is applied are numerous and can be beautifully produced from metals such as gold, silver, bronze, copper, brass and sometimes pewter, but pewter being a soft composition and easily melted is not used very much. For the best work cold rolled copper is used, and for secondary ordinary copper. A very suitable grade is known as soft-bright copper and is used extensively. However, when the metal is not sufficiently ductile for the requirements it may be improved by annealing. To produce good work the metal should always be properly prepared by being carefully planished and freed from all visible flaws that would afterwards be seen, and soft stock should be selected especially when using brass which varies greatly in composition, and if worked without the proper annealing is liable to crack, break or tear.

(To be continued.)

AMERICAN INVAR.

This important alloy of nickel and steel, containing about thirty-six per cent of nickel is now being manufactured in the United States. One of the most valuable properties of the alloy Invar is the fact that the co-efficient of linear expansion of the steel is practically zero and this makes the metal of value in the construction of all manner of accurate measuring instruments. Heretofore this alloy has been made only in France, but recently the Midvale Steel Company at Philadelphia, Pa., undertook to develop a nickel-steel alloy having the properties of Invar and according to some tests made at the Bureau of Standards, Washington, D. C., the efforts have been successful and the metal is now produced under the name of Gamma steel.

The United States Coast and Geodetic Survey, Department of Commerce, Washington, D. C., has ordered a number of Gamma steel strips which, when mounted in a suitable rod, will carry the significant part of the graduation, only the numbering and counting characters being placed upon the rod. The object of this is to make the results of the leveling independent of errors due not only to temperature effects, but also those arising from the unstable structure of wood, even when made non-hygroscopic.

The Bureau of Standards proposes to issue a series of circulars of information on the properties of the more interesting or technically important metals and alloys. The first of the series, describing the properties of the non-expansible alloy Invar and other nickel steels, has just been published.

The publication is Circular No. 58, entitled "Invar and Related Nickel Steels," and copies will be sent free to interested persons upon application to the Bureau of Standards, Washington, D. C.

EFFICIENCY SYSTEM AS APPLIED TO THE MANUFACTURE OF PLATED WARE

Some Comparisons Between Theory and Practice in the Production of Silver Flatware.

By C. W. Cook.

There has been a general cry for efficiency and still more efficiency to determine the cost of manufacture of the multitude of items generally termed and known as flat ware. This cry has been caused and brought about in many ways. Considerable might be said why more system in manufacturing plants is necessary today than in the years gone by. When a manufacturer of plated ware was able and did show a good profit in the business. When he balanced his books at the end of each year. It has been said and we will assume it to be the case that conditions of today are so much changed that it is not possible to manufacture plated ware on the same plan and methods as were in vogue forty years ago. Sharp competition, increased cost of manufacture and many other causes are given as why this condition exists today. The writer admits that the changes in conditions are responsible for the loud cry for system and efficiency, but questions the fact that elaborate systems which have been installed in many plants have saved money or cheapened the production of the product. In fact, in many cases the cost has been materially increased and the work decreased in quality. We will, for illustration, take a unit of 10 gro. of common Al Windsor Table Spoons, made on order No. 21, which are to be insided or finished inside the bowl in the finishing department. The operator starts these at 7 a. m. and has them finished at 5.30 p. m., working 10 hours on this unit. These are passed through the subsequent operations and go to the inspector. Very few are thrown out for poor workmanship and the lot go to the plating department as commercially perfect. In another few weeks there is another lot made from a different lot of metal of the same kind and grade of spoons. This lot we will call made on order No. 83. This lot of spoons was made by the same workman and on the same tools as the other order No. 21. We give out the same unit of 10 gross to the same operator that insided or finished inside the bowls of the 10 gross on order No. 21 in the finishing department. He starts on these, say, at 7 a. m. After a little while he takes some to the foreman and complains of them as being hard to finish and he can not finish them as quickly as he did those a few days ago which was on order No. 21. The foreman will look them over and tell the operator that they are just the same as the previous lot and to hustle them through in 10 hours, the same as order No. 21 was put through. The operator does his best, but to get this lot through in the 10 hours it is not possible to finish them as they should be when quitting time came and he has worked his 10 hours on the lot. He finds he has one more gross left over which he could not finish and is obliged to spend another hour to finish them the next morning. We will assume this operator was paid 25 cents per hour. The first unit of 10 gross on order No. 21 cost the company for this operator $2.50, and on the unit of 10 gross on order No. 83 it cost the company $2.75. This lot was put through the subsequent operations and taken up to the inspector. We will assume this unit was on a rush order and the inspector was directed to hurry them through. Many were returned to the finishing department for poor workmanship and many others which should have been returned for the same cause were rushed through to fill the special order. So we have on order No. 21, a unit of 10 gro. Al Windsor table spoons perfectly finished for market, but on order No. 83 we have a unit of 10 gro. of same grade of spoons many of which are imperfect together with extra cost of labor and material.

Now the efficiency expert who, perhaps, has never had any practical knowledge or experience in the manufacture of flat ware will say the operator was at fault because the record showed that the same man had finished the first 10 gross in 10 hours and then taken 11 hours for the second 10 gross of the same kind and grade of spoons. To the writer's mind this shows a big flaw in efficiency as practised and applied in the manufacture of flat ware.

Now there was a cause why the second 10 gross of Windsor Table Spoons should not be as easy to finish as the first 10 gross unit. We will mention some of the reasons why one lot of goods made from one lot of metal as made at the mill differs from another lot of the same kind and grade of goods made from another lot of metal by the same mill. One of the reasons which may be given is a non-uniformity of the metals which was used in lots Nos. 21 and 83, and this only illustrates the fact that there is no product made of metal which is absolutely uniform. Another cause may be that the metal as cast and rolled at the mill was made under a strict efficiency system, making quantity the first requirement and perhaps a letting down of quality of the product. We believe that much credit should be given the metal manufacturers in making a strenuous effort to produce a uniform quality of the metals which are used in making German silver for their customers who manufacture flat ware, and the copper spelter and nickel they use are commercially pure and perfect. And so with the manufacture of metals and the making of products from metals it is very necessary that a high standard should be established and the metal manufacturers should and, we believe, do make every possible effort to furnish their customers with a uniform quality of goods. And so with the manufacture of plated ware, there should be a high standard of efficiency both in quantity and quality of the product.

The greatest defect in an efficiency system comes from the fact of its being very much overdone. We believe that every manufacturer should maintain sufficient system to absolutely be sure of the cost of the product, but when that is obtained we do not believe it necessary or economical to establish and maintain, in many cases, a more elaborate and useless system of red tape and perplexing annoyances for the operators employed in the actual manufacture of the goods, and the writer believes a competent foreman can produce better results both in quantity and quality under a simple and at the same time accurate system, rather than under a system of very complicated and in many cases useless methods. We believe a foreman of any department should be responsible for the quantity and quality of his product and we further

believe that a first-class foreman of any department with his knowledge of the work and with proper assistance should be able to give as accurate a cost to the company of each individual article going through his department at far less cost to the company than under the most elaborate system worked out and established by the efficiency experts of the present day. Most of these experts with their technical knowledge contend that a splendid elaborate system is about all that is required in the manufacture of goods. They further maintain that all brain power necessary for best results should emanate and be established from the head of the system. We believe that such methods have a tendency to make the workmen more thoughtless and careless with their work. For various reasons it is very seldom that we find a man of technical knowledge and training who gets down to the machine or bench and learns the practical part of manufacture, so we find that in many cases a man of splendid education and technical training only looks at the operations done in actual manufacture from a technical point of view and assumes that many operations can be eliminated or done by another method and yet get the same results. But when such changes are made and operations eliminated under the suggestions as made by the efficiency expert they many times only result in failure and expenditure of time and money and considerable actual loss to the company. The writer believes that a workman with brain power and who is allowed to use it, together with experience and ambition, makes a far better workman for any company than a man with only physical ability as his greatest asset in the manufacture of flat ware, and the writer is led to the conclusion that it is good policy to build up and maintain a manufacturing plant with men of experience and efficiency, who can and will produce good results under proper methods, rather than with workmen under an elaborate efficiency system and little interest in their work or their employers.

I believe system in any business is very necessary but do not think it good policy to carry efficiency systems to the danger point of retarding a workman in his daily output or quality of his product. In other words, I do not think any system of efficiency alone without the co-operation of the employees of a plant can produce the best results in the quantity and quality of goods produced, and I believe the best system any manufacturing plant can install and maintain can be worked out and put in operation by the workmen employed, who with their experience and ability are far better able to work out an efficiency system that will be efficient and more satisfactory than can be obtained by technical knowledge alone.

Some time ago the writer read a story of a Mr. Brown who had carried on a manufacturing business for many years. Mr. Brown knew the business in all its details and attended strictly to his business, with the result that he maintained his business and made a satisfactory profit. In due time Mr. Brown received a call from an efficiency engineer who tried to persuade Mr. Brown that his business, run under his present methods, would lead him to bankruptcy. Mr. Brown was getting old, and finally after much talk and argument by the technical man was persuaded to allow the gentleman to install a system, of course at a big expense to Mr. Brown. The system, the story says, was installed in due time, or rather a long time, as the efficiency expert was drawing his salary at so much per day or week. Anyway, the expert finally went his way, leaving Mr. Brown with the system on his hands. He procured an office force to run the system which, of course, swelled his payroll to enormous figures. The quantity of his product decreased and the quality was far below his usual standard, but Mr. Brown was game and he fought it out like a man. This fight of Mr. Brown's was carried several months till conditions had reached the limit and Mr. Brown had decided to either go back to his former profitable method of doing business or close up the plant. Just as he had made up his mind to do one or the other, the gentleman who had installed the system gave him a call. After conversing on several matters a short time, this efficiency gentleman said, "By the way, Mr. Brown, how is the system working out?" Mr. Brown said, "Well, sir, I never saw anything like it. Do you know, sir, we have been working hard on the system and have about got it perfect. Of course, we have been unable to manufacture very many goods, it has been system, system and more system and we could find no time to make or sell goods, so I have decided, as we have mastered this efficiency system, I am going back to my former methods of manufacturing and try to get my men interested and see if I will live long enough to make up in money what the system has cost me. Good day, sir."

Now the writer thinks Mr. Brown was quite a long time in making up his mind, but his case is only one among many who have an idea they must have system at any cost and work on these lines alone till they, like Mr. Brown, are ready to close up the plant or go to some insane asylum where they can have opportunity to work out systems without the worry and care of trying to do business and show a profit to their stockholders.

The writer believes that the management, together with the co-operation of employees in a manufacturing plant, should go to make up the system for the plant. This, together with experience and a thorough knowledge of the details of the business and ambition applied along proper lines, can and will establish exact cost of material and labor together with applied burden or overhead expense in all departments, to the end that the product can be placed in market with exact knowledge of cost of same. And I may not be far wrong in my conclusions that if the manufacturers of the present would again take up some of the methods of their ancestors and pioneers in the business, they would show more profits and to a large extent eliminate the unrest and dissatisfaction of their employees.

INDIANS FOR BRASS CASTERS.

At the Lachine plant of the Dominion Copper Products Company, Lachine, Quebec, Canada, the casting shop for the manufacture of wrought brass ingots is now in operation. In contrast to the labor conditions in the United States it is interesting to note that Ferdinand Deming, the engineer of the company, reports that they are using Indians for casters' helpers and at the present time one ambitious redskin is being taught to cast. Mr. Deming remarks that "it is quite a far cry from the scalping knife and tomahawk to the pouring of brass."

ALUMINUM PRODUCTION.

Aluminum production in the United States totalled 80,000,000 pounds last year, against 15,000,000 pounds in 1906, and only eighty-three pounds in 1883.

THE MANUFACTURE OF ADMIRALTY GUN METAL IN ENGLAND

Some Notes Regarding the Production of the Bronze 88 Copper 10 Tin and 2 Zinc Now So Much in Demand for War Purposes.

By H. S. Primrose, M.T.M.*

At the present time, when so many firms are undertaking for the first time the production of the bronze known as Admiralty Gun Metal, to conform to Government specification, it is hoped that these notes will be of more than passing value in assisting them to solve the somewhat troublesome problem of turning out considerable quantities in a limited time.

The first point to consider is the selection of the material which is most suitable for the work, and in doing so it is wise to remember that the cheapest articles, if collected as component parts in the brass foundry, are very apt to become the dearest in the long run by causing endless breakdowns, faults in the castings and trouble in the machining operations, followed most likely by final rejection of the finished material. This applies with equal force to both working appliances and to the metals employed, and in the purchase of the latter it is always advisable to deal with reliable firms, and keep accurate records of all the impurities introduced into each charge, in order that they do not exceed the specified limit. Dealing first with the raw materials to be purchased, the form in which the constituent metals may be obtained varies to a remarkable extent, and the degree of purity to which they may attain differs very considerably. The purity of the metals used has a most profound influence on the proper melting, casting and physical properties of the resulting alloy.

COPPER

The chief component of gun metal, as of all other bronzes, is copper, and this comes into the market in a variety of forms suitable for the alloy maker. The most common form is in small ingots of about fourteen pounds weight, which are cast in chill molds so as to produce one or two notches in the bottom for the purpose of facilitating the breaking up into smaller pieces for use in charging into crucibles. Some makers and smelters put larger ingots on the market, and these are more convenient for reverberatory furnace practice than for crucible melting. Occasionally slabs or cakes may be got, although these are chiefly employed for rolling into sheets and plates. Scrap copper must be used with great care, and only such forms as have been used for electrical purposes may be used in alloy making without first melting, sampling and analyzing. All miscellaneous forms of copper scrap are almost certain to contain some deleterious impurity, and such metal as roller ends, clippings and turnings should invariably be melted down and analyzed before use, as they frequently contain arsenic to a harmful extent, and possibly also iron and lead. The greatest caution is advisable in using "mysterious" ingots of unknown origin, even although sold under the meaningless name of "B.S." The old process of best selecting, as practised at Swansea, has now fallen into disuse, and the initials which at one time stood for high-grade material containing not more than 0.05 per cent. of arsenic, and only a trace of antimony, are now without meaning.

The impurities which may be present in commercial copper do not always interfere with the good qualities of the metal, even if present in such quantity as would be harmful when the copper is alloyed. Sometimes quite considerable quantities of impurity may be present in the copper without reducing its strength or ductility, but it will depend upon what alloy is to be made with the copper, whether or not these impurities will interfere with the physical properties of the final alloy. Thus, for example, it is deemed advisable to use copper containing about 0.5 per cent. of arsenic for certain purposes, such as fire-box stays and plates, as this increases the life of the material under repeated stresses at high temperature. This percentage of arsenic would, however, render the copper quite useless for the manufacture of 70-30 brass which was required to be worked in the cold, but it is not necessarily harmful if the copper were used in the making of brass which only required to be cast and to contain 40 or more per cent. of zinc. The chief impurities to be found in commercial copper are arsenic, antimony, iron, lead, nickel, bismuth and oxygen, and those which require to be most carefully guarded against in making Admiralty gun metal are arsenic, antimony and bismuth, as these have the most powerful influences in rendering the alloy brittle and deficient in tenacity.

The following table of typical analyses of commercial coppers is useful as a guide in selecting a suitable brand, and it will be readily seen what kind of material is to be avoided:

Per cent.	(1)	(2)	(3)	(4)	(5)	(6)
Arsenic ...	0.01	0.007	trace	0.025	0.32	0.52
Antimony ..	trace	trace	trace	trace	trace	0.05
Iron	nil	0.001	0.024	0.006	0.01	1.263
Lead	trace	nil	nil	0.024	0.07	0.205
Nickel	nil	nil	0.047	0.041	0.06	trace
Bismuth	nil	nil	nil	0.011	0.01	trace
Silver	nil	nil	0.036	nil	nil	nil
Tin.........	nil	nil	nil	nil	nil	0.472
Oxygen	nil	0.08	0.07	0.143	0.12	0.15
Copper	99.98	99.91	99.97	99.75	99.41	97.34

No. 1 is the analysis of a pure electrotype copper as removed in nudules from the depositing tanks, it contains small traces of occluded gases which are expelled when the metal is remelted for casting into ingots. No. 2 is a standard brand of electrolytic copper which has been melted and cast into ingots, which accounts for the small quantity of oxygen which has been taken up in this operation. No. 3 is a high-grade copper from Lake Superior district, and it is characterized by the almost complete absence of arsenic and antimony, and by the presence of small quantities of silver, nickel and iron. No. 4 is a good type of English "B.S." copper which may be taken as a useful standard for alloy making. No. 5 is a very good brand of English tough copper, although not quite so serviceable as No. 4 for alloy making. No. 6 is a nameless brand supplied for the making of gun metal, and which lead to serious trouble and a number of rejections.

The difference in price between electrolytic and "B.S." copper of high grade is usually so small that it is preferable, whenever possible, to use the former, and it is specially valuable to have in stock as an enricher of any scrap material which may require to be used up.

TESTING THE METAL.

It is not advisable to rely upon a judgment of the fracture of a copper ingot for an indication of its purity. The appearance of the fracture is only serviceable in indicating that the metal has been cast at the proper "tough

*Metallurgical Engineer to the Crittall Mfg. Co., Ltd., Braintree.

pitch." If the copper is "dry" that is cast, before poling has been completed and the requisite quantity of oxygen removed, the ingot will be over rich in oxygen. It will then cast with a depression on the top, and a test sample will break short and the fracture presents a dark red granular appearance. If the copper has been over-poled, and too much oxygen removed, the surface of the ingots will be raised above the edges, and bright specks will show themselves on the fractured face of a test piece, which is again brittle. But if the metal has been cast at the correct "tough pitch," the surface of the ingot is neither depressed nor raised, but it presents a characteristic wrinkled appearance. The fracture of tough pitch copper is silky and fibrous, and the test should bend through a right angle before breaking.

The specific gravity of copper is 8.9, so that the density may be taken as 555 lbs. per cubic foot. As cast, its tensile strength is about 14 tons per square inch and wrought copper in the form of wire may reach 25 tons tensile strength. The melting point of pure copper is 1085 degrees Cent. (= 1985 deg. F.), and the heat required to raise the temperature of one pound of the metal from atmospheric temperature to 100 degrees Cent. above its melting point is—

$$= 0.096 \times (1085 - 15) + 0.133 \times 100 + 44$$
= 158 Centigrade Thermal Units or
= 284 British Thermal Units.

TIN.

The next most important item in the manufacture of gun metal is tin. This metal is usually obtained in ingots or cakes of very great purity, and recognized brands may be depended upon to give reliable results. The chief impurities which may be present in commercial tin are antimony, iron, lead, arsenic, bismuth and sulphur, and of these the three last are to be specially guarded against. The following typical analyses show the usual percentages of these impurities in commercial tin:

Per cent.	(1)	(2)	(3)	(4)	(5)	(6)
Antimony ..	0.007	0.015	nil	0.245	0.176	0.569
Iron	0.045	0.042	0.041	0.016	0.014	0.007
Lead	trace	0.037	0.165	0.223	0.177	0.546
Arsenic	nil	0.063	trace	0.065	0.053	0.042
Bismuth ...	nil	0.005	nil	0.015	0.017	0.055
Sulphur ...	trace	0.008	trace	0.013	0.008	0.004
Tin	99.95	99.795	99.794	99.35	99.16	98.71

No. 1 is the analysis of a sample of Straits tin, which is all of high grade. No. 2 is a reliable brand of Tasmanian tin. No. 3 is an example of Queensland tin, and Nos. 4, 5 and 6 are good samples of Cornish tin. Certain brands of tin from Peru and Bolivia are the most impure on the market and these contain chiefly lead and antimony. Australian tin is generally of high grade, but some brands contain a deleterious amount of bismuth.

Tin has a specific gravity of 7.3, thus 1 cubic foot weighs 455 lbs. Its melting point is 232 deg. Cent. (= 450 deg. F.) and to melt one pound of it and superheat 100 deg. Cent., the number of heat units required is

$$= 0.056 \times (232 - 15) + 0.064 \times 100 + 13.7$$
= 32 Centigrade Thermal Units, or
= 58 British Thermal Units.

ZINC.

Zinc is one of the minor constituents in gun metal, but the part it plays is none the less an important one. This metal is chiefly put on the market in the form of thick cakes and sold as "spelter," and for making gun metal it is most desirable that it should be virgin metal, that is to say, made by a distillation process and not from remelted scrap or hard zinc which has been sweated. As the amount of zinc used in the manufacture of gun metal is not large, the amount of impurities allowable is greater than in the other constituents, and the only one which requires to be carefully attended to so that it does not become excessive is iron. In the manufacture of brass it is important to carefully regulate the amount of other impurities such as lead and cadmium, but these are secondary considerations in zinc for making bronze alloys. The purity of zinc may be comparatively readily judged by the appearance of the fracture, as only the purest metal gives bright facets completely traversing the cake of "spelter," and even the smallest traces of iron introduces dark specks on the crystal faces, and the bright bluish-white color is reduced in brilliance by the presence of other impurities, such as lead. The following table of analyses shows typical examples of the character of commercial zinc:

Per cent.	(1)	(2)	(3)	(4)	(5)	(6)
Lead	0.007	0.095	0.05	0.51	1.30	2.50
Iron	0.010	0.012	0.03	1.72	1.42	1.83
Cadmium ..	0.004	0.043	0.07	0.06	0.03	0.10
Tin and Antimony ..	nil	nil	0.05	0.03	0.01	0.01
Zinc	99.979	99.85	99.85	98.66	97.22	95.56

No. 1.—Is the best electrolytic zinc made in England. No. 2 is a special brand made in Scotland by a distillation process. No. 3 is an excellent American brand. No. 4 is an ordinary English brand. No. 5 is a good Welsh brand. No. 6 is a low grade English spelter.

The specific gravity of zinc is 7.15, so that the weight of 1 cubic foot of the metal is 445 lbs. Its melting point is 419 deg. Cent. (= 786 deg. F.). It volatilizes at 930 deg. Cen. (= 1.706 deg. F.), which means that it boils when added to molten copper, and the vapor burns readily in air with the formation of the flocculent oxide, known as "Philosopher's Wall," which is yellow when hot, and white when cold. The specific heat of zinc is high, so that the heat required to melt one pound and raise its temperature 100 degrees above the melting point is

$$= 0.109 \times (419 - 15) + 0.127\ (100)) + 22.6$$
= 79 Centigrade Thermal Units, or
= 142 British Thermal units.

LEAD.

Lead is not as a rule an intentional addition in the manufacture of gun metal, but is usually present in small quantity, and it is now tolerated to the extent of 0.5 per cent. As it is a very soft metal it produces a slight softening effect on the bronze, and it is helpful in making the gun metal, which is ordinarily somewhat tough to cut, more easily machined. It melts at 327 deg. Cent. (= 620 deg. F.) and while when molten it is completely dissolved in the alloy, it separates out completely as metallic lead when the gun metal is cast and becomes completely solid. If the cooling be very slowly accomplished then the lead segregates into rather large patches irregularly distributed throughout the mass, although chiefly near the bottom, but quick cooling leaves the lead scattered in very finely divided particles through the whole structure. On account of its high specific gravity, which is 11.4, its tendency is to sink to the bottom of the metal, so that the molten alloy requires to be well stirred before casting when more than a trace of lead is present. Even without any lead present it is always advisable to insure as complete homogeneity of the metal by stirring, and this also assists in the removal of included dross which might be carried into the mold to the detriment of the casting.

PREPARATION OF GUN METAL.

The alloying of the various constituents which have such widely different melting points and densities is somewhat troublesome unless done in the proper manner. It is always necessary to melt the copper first, as it has the highest melting point, and in doing this it should be protected from the gases of the furnace as far as possible by means of a suitable covering such as powdered charcoal, glass or common salt. This prevents loss by oxidation and also the embrittling of the alloy by the solution in it of oxide of copper. The tin in suitably sized pieces is introduced to the crucibles containing the copper at a temperature of about 100 degrees above its melting point. This must be well stirred in and not sufficient added at one time to chill the copper to a pasty condition, otherwise excessive time is required to bring the mass into a molten condition again. The tin is so much lighter than the copper that it tends to float on the surface, hence the necessity of stirring it in well. It is also so readily oxidized that even when the bronze is raised to full red heat again the alloy contains admixed through it some particles of tin oxide (putty powder) and these are most difficult to remove completely by stirring only. The small quantity of zinc is added for this purpose, and as it suffers loss both by volatilization and by oxidation, a small allowance (say 0.5 per cent.) must be made to compensate for this. The oxidation is due partly to direct burning when it is introduced into the molten bronze, and partly to its action of reducing the tin oxide to metal and at the same time passing into zinc oxide.

It will thus be seen that the calculation of a charge say of a 60-pound crucible charge is a very simple operation, if only pure metals are used, but it is also quite possible to work out the requisite proportions of large or small furnace charges in which it is proposed to utilize suitable quantities of scrap material provided the analyses of these is known with a fair degree of accuracy. In a subsequent paper it is proposed to give examples of this, with details of the proper casting temperatures for various weights of casting, and also to discuss the layout of various sizes of shop and plant suitable for melting gun metal either in crucible or reverberatory furnaces.

(To be continued.)

TIN SMELTING IN THE UNITED STATES

A REPORT OF PRESENT CONDITIONS AND OUTLOOK FOR THE FUTURE.

As has been referred to before in THE METAL INDUSTRY the embargo imposed on the exportation of tin by Great Britain has caused considerable uneasiness and activity among the users of tin in the United States, and the current issue of the bulletin of the Pan-American Union gives some interesting facts relating to the situation. The article referred to says as follows:

"First, what is the industrial and economic position of the United States in the production of tin plate? It is only a few years ago when nearly all the tin plate used was imported from Europe, principally from Great Britain. The development of the iron and steel industry has entirely changed this condition, so that at present but little or no tin plate is imported. This country now makes all its plates and imports the tin with which to cover them. But why has not the United States, the largest user of tin in the world, consuming as much as Great Britain, France, Germany, Austria and Belgium combined, imported the ore and done its own smelting? More in particular, why has it not imported Bolivian ore? To answer the second question first, because tin produced from Bolivian ore by the established methods of smelting, whether in Bolivia or in Europe, contains impurities which render it must less suitable for tin plating than tin produced from the ores of the Straits. Bolivian tin may be just as good as Straits tin for other uses, but for tin plating, the principal use of tin in the United States, it is not so good.

"A chemically pure metal is not often demanded in the arts and industries and but few metals are ever reduced to the chemically pure state. Sometimes it happens, however, that a certain kind of impurity, even though occurring in infinitesimal quantities, renders a metal unsuited for a certain purpose. Other impurities may be tolerated, but this impurity cannot be. It is so with Bolivian tin. One of the impurities which makes it unsuitable for plating is iron, and from this impurity the Straits tin is free. Ferruginous tin, even though the iron content be exceedingly small, will not readily adhere to steel and iron plates.

"It is plain to see why, under conditions heretofore existing, Bolivian tin has found but little market in the United States. Why tin ore of no kind—except in inconsiderable quantities—has been smelted here is simply because the United States, being forced by the metallurgical condition to use East Indian tin principally, was met by a discriminating export tariff duty which prevented its bringing the ore and compelled it to buy the metal. A number of years ago a tin smelter was erected in Bayonne, N. J., for the treatment of Straits ore, but before the smelter could get into operation a protective export duty was placed by the Federated Malay States on these ores and tin smelting in the United States never even got a start.

"The United States could not use the Bolivian ores and it could not get the East Indian ores, and that is the whole story in a nutshell.

"But the arts progress. Recent advances have been made in the industry of tin smelting and refining. Electricity, which has revolutionized so many other industries, is revolutionizing tin refining. Electrolytic tin is almost chemically pure tin. Analysis show 99.98 per cent. pure, produced from metal only 93 per cent. tin. Electrolytic tin is pronounced by tin-plate manufacturers as equal in every respect to the best Straits tin. Finally, Bolivian tin can be refined by the electrolytic process. Herein have been forged, ready for the placing, the links until now wanting in the chain between Bolivia and the United States.

"The American Smelting & Refining Company has recently completed at Perth Amboy, N. J., a plant for the smelting of tin ores and concentrates and the electrolytic refining of tin. In order that the conditions that arose when the Bayonne smelter was built, through imposing discriminating export duties by the ore-producing country, might not again occur, the American capitalists interested in tin smelting entered into direct negotiations with the Bolivian Government."

CASEIN METAL

Casein is a white amorphous body obtained from cow's milk, in which it is present to the amount of about 3 per cent. Casein has a number of industrial uses. When treated with formaldehyde and subjected to heavy pressure it is known as Galalith and is used for making combs, penholders, buttons, dominoes and other small articles. It may be given various colors and is not inflammable like celluloid. It is also used for making films, water paints.

If the name "Casein" has been applied to an alloy it is most likely a zinc base die casting alloy or an aluminum alloy of milk white color.—J. L. J.

EDITORIAL

OLD SERIES
Vol. 22. No. 4

NEW YORK, APRIL, 1916.

NEW SERIES
Vol. 14. No. 4

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CONTENTS

MANGANESE BRONZE

The fitness of the name manganese bronze as applied to the mixture of copper and zinc with varying amounts of tin, iron and manganese has from time to time aroused discussion not only among scientific societies but also among the users of the material. A considerable amount of journal space and also talk has been devoted to the settlement of the question as to whether the above mentioned alloy should be termed a brass or a bronze, but at the present time the subject has not been definitely settled. The committees on standard nomenclature for alloys of both the English and our own Institute of Metals have not mustered up sufficient courage to tackle the problem definitely.

In view of the above it is rather interesting to note that the city officials of Seattle, Washington, have taken the matter in their own hands without waiting for the metallic decision of the scientists to be announced and have decided the question for their own satisfaction, if not to that of all concerned. The attention of THE METAL INDUSTRY to the matter was called by a foundry which has always borne the most excellent reputation for producing metals and alloys that run true to form, and as the matter had been all finished before the foundry mentioned brought it to our attention, the former could not be accused of being unduly interested outside of a desire to have things done in proper shape.

It seems that the City of Seattle, Wash., advertised for manganese bronze stems for valves for the water department. The successful bidder on the order, it was charged, substituted for the manganese bronze what was claimed to be gun metal or some other metal inferior to the manganese bronze advertised for. Upon the protest of the unsuccessful bidders the city had an analysis made of the material which had been furnished them, and at the same time THE METAL INDUSTRY was requested to give a ruling on the subject. All THE METAL INDUSTRY had to go on was the report of the city chemist of an analysis made upon a fire hydrant stem. The chemist's report was as follows:

The borings were taken from the extreme lower end of the sample and were therefore not an average of the whole piece.

ANALYSIS.

Tin	10.470%
Lead	.196%
Copper	86.780%
Zinc	2.117%
Iron	Trace
Total	99.563%

From the above analysis it would appear that the metal was made from Parsons' No. 2 formula, which is taken from

Kent's Handbook, page 331, which is said to be the results of an analysis made from samples taken from the United States battleship "Maine."

J. G. Priestly, City Chemist.

Basing our report, as stated above, upon the only facts in the case that we had at our disposal, viz., the above analysis, our decision was rendered as follows:

"The analysis of fire hydrant stem given by J. G. Priestly as Parsons' manganese bronze No. 2 is in reality of the mixture known as 88-10-2, gun bronze or admiralty metal.

"Mr. Priestly has quoted an analysis claimed to be found on page 331 of Kent's Handbook. In the eighth edition of this reference book (1912), no such analysis can be found on page 331. On page 377 some physical tests of metal from the pouring-gate of propeller-hub of the United States battleship 'Maine' are given but no analysis. The following analysis is given of the propeller of W. K. Vanderbilt's yacht 'Alva': Cu. 88.64; Zn. 1.57; Sn. 8.70; Fe 0.72; Pb. 0.30; P. trace. While this alloy is referred to as Parsons' manganese bronze No. 2, it is one of Parsons' early formulas and is really a ferro-bronze and contains phosphorus instead of manganese.

"The alloy he gives has a tensile strength of only 30,000 pounds with 15 per cent. elongation or about half the strength and half the elongation of manganese bronze. Mr. Priestly has either by design or by mistake twisted the data given in Kent, for on page 377 the analysis of Parsons' manganese bronze No. 2 is given as Cu. 56.11; Zn. 41.34; Fe. 1.30; Sn. 0.75; Al. 0.47; Mn. 0.01; Pb. 0.02.

"This composition is the one that is now generally used for making manganese bronze castings, and it is coming into use largely for sand cast valve stems, etc. If a tensile test had been included in the specifications of the City of Seattle, the 88-10-2 mixture could never have been used."

The W. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa., were asked for their opinion upon the matter, and their reply was as follows:

"The analysis shows it is not Parsons' manganese bronze nor any other kind of manganese bronze. It is evidently an attempt to furnish government composition G and the metal is probably made from scrap.

"Manganese bronze contains from 75 to 60 per cent. of copper, about 38 per cent. of zinc and the balance tin and iron. There is no possible way that manganese bronze can be made by the usual brass foundry methods; that is, by making a simple mixture. The formula is complicated and calls for three or four different mixings.

"In regard to the formula in Kent's Handbook, page 331, this is entirely erroneous. The Parsons company, all of whose formulas we have, never used such a metal for manganese bronze, and the wheel from which the sample in question was taken was evidently made of government composition or gun metal.

"By the way, in our copy of Kent's Handbook the analysis to which you refer was made from a sample from the propeller of the yacht 'Alva' and not from the battleship 'Maine.' However, this is immaterial, as no matter what vessel the sample was secured from, the formula is not that of Parsons' manganese bronze No. 2 nor any other manganese bronze."

W. P. Smith, Superintendent of Sales.

In spite of the above expert reports, we understand that the City of Seattle did finally and definitely accept the metal as per above analysis and ordered the payment of the bill, so we regret to have to admit that the solution of the problem—When is Manganese Bronze not Manganese Bronze?—is as far off as ever. Perhaps the City of Seattle can enlighten us further.

Of course, it may be claimed on behalf of the city that, inasmuch as the metal actually furnished did fulfil completely the requirements set forth by the specifications with the exception of answering to the name "manganese bronze," the contract had been filled. In this event, however, it would seem that the original specifications should have been phrased so as to include *equivalents* of *manganese bronze* or of a metal which would perform the same work for the amount of money involved.

The question as to whether a misfit government bronze, such as the mixture exhibited by the analysis above, would perform the work and possess the characteristics of a well and carefully compounded true manganese bronze, does not apparently enter into the situation. The Metal Industry cannot pass definitely on this point as to what the future results will be, but we have no hesitation in saying that we do not believe that such a mixture will give enduring satisfaction in any engineering construction.

NEW BOOKS

Brass-Moulder Illustrated, 1915—By Alex Purves. Size 5½x7½ inches. 162 pages. 85 illustrations. Bound in boards. Published by Spon and Chamberlain. Price $1.25. For sale by The Metal Industry.

A practical guide for the apprentice and young journeyman. Contents: Core-making in all its branches; making a furnace for brass alloys; fine brass work; brass alloys; light brass-moulding; fine metal work; to mould a false cored figure; clay, gelatine and wax modeling; green-sand moulding; stump and spindle moulding; skeleton and core box-making; to make a skeleton from a pattern; loam core-making; marine engine work; various methods of working; what to do and what not to do in brass-moulding.

The Journal of the Institute of Metals, Volume XIV, No. 2, 1915. Edited by G. Shaw Scott, secretary. Size 6 x 8½ inches, 240 pages, with index and numerous illustrations. Bound in boards. Published by the Institute of Metals, Caxton House, Westminster, S. W., England. Price $5.00 net.

Added interest now attaches to the publications of the Institute of Metals by virtue of the fact that the working of the non-ferrous metals, which is described in the Journal, is of such paramount importance in the production of munitions. The subjects dealt with in the Journal, that has just been published, are of a very varied character, ranging from steam turbine blading—a vital matter for ships—to the detection of internal blow-holes in metal castings by means of X-rays. A paper dealing with the constitution of brasses containing small percentages of tin cannot fail to be of great interest to brass founders, while another, describing a new thermostat for moderate and high temperatures, will appeal to the scientists in the works' laboratory. Other papers deal with such subjects as corrosion and the structure of alloys as affected by mechanical strain and other causes. Sir J. J. Thomson, O. M., D. Sc., F. R. S., makes an extremely valuable contribution on the "Conduction of Electricity Through Metals," and arrives at important new conclusions.

In addition to these original communications the Journal contains some hundreds of concise abstracts of papers dealing with copper, brass, aluminum and other non-ferrous metals and alloys, which have appeared during the past six months in various scientific and industrial publications throughout the world. These abstracts should be very valuable for speedy reference in works and laboratory. The Journal is fully illustrated, containing 15 full-page plates, together with numerous diagrams and photographs in the text.

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

TEST OF HACK SAW BLADES

[The article which appeared in the January issue of The Metal Industry on "A Test of Hack Saw Blades" has aroused some little criticism and the letters which are published below, we hope, will furnish a basis for some scientific discussion of the matter. The Metal Industry would be pleased to hear from anyone who has had experience in this direction.

It does not seem to be necessary to state that there is no ground whatsoever for the assumption made by Mr. Baldwin. As was stated in the article when it appeared in The Metal Industry, Mr. Harper made the tests there described entirely for his own satisfaction and benefit, and no saw blade manufacturer had any notion that such a test was being made. And also Mr. Harper was persuaded with difficulty to allow the results of his test to be published.—Ed.]

To the Editor of THE METAL INDUSTRY:

The writer was greatly interested in the article entitled "A Test of Hack Saw Blades" in the January number of THE METAL INDUSTRY. Having had an experience covering about twenty years in the use of hack saws, and naturally having tried most of the makes, I must confess that I was surprised that such well-known saws as Victor, Quality, Milford, etc., should take so much longer than some other saws, everything being equal, to make ten cuts in the stock mentioned in Mr. Harper's article. It seems almost incredible that the Victor should take 40 minutes for the third cut, with no signs of finishing the fourth cut. It also seems out of proportion, to those who have used the saws named, that the Quality should take 105 minutes for the tenth cut, as against 7 minutes 58 seconds for the Star.

It would be interesting to know the relative standings if the 36 cuts had been continued, say, with the third saw—the Starrett—as well as with the Star. I find, on analyzing the first 10 cuts of these two blades, that the Star took 2 minutes 18 seconds more to make the tenth cut than the first, while the Starrett took only 1 minute 59 seconds more to make the tenth cut than the first, a gain for Starrett of 19 seconds, or about 7 per cent. The Star took 1 minute 37 seconds longer to make the tenth cut than the sixth, while the Starrett took only 1 minute longer to make the tenth cut than the sixth, a gain of 37 seconds, or a little more than 35 per cent for the Starrett over the Star in these 5 cuts, showing that the Starrett blade was apparently in better condition than the Star at the end of 10 cuts.

The fact that the Starrett blade made the seventh and eighth cuts in 7 minutes 30 seconds, and the ninth and tenth cuts in 8 minutes 14 seconds, shows that it was in that condition which a saw having the correct set to the teeth reaches after the extreme sharpness wears off, when it maintains an average cutting time for a number of cuts. A saw with teeth set like a wood saw will always cut faster while sharp than one with teeth set so that the points are at right angles to the work, as in a cutting-off tool, but the latter will outwear the first every time, everything else being equal, and will cut faster as well, as will be borne out by Mr. Harper's figures. In view of these facts it would seem to the writer that Mr. Harper's test is of little value to users of hack saws in general and would hardly be entitled to the distinction of "adding considerable to the literature relating to foundry practice" or to machine-shop practice.

4537 Springfield avenue, D. MOFFAT.
Philadelphia, Pa., March 11, 1916.

To the Editor of THE METAL INDUSTRY:

The copy of your January issue which you sent with your letter of March 16 has been received and the article on page 21—"A Test of Hack Saw Blades"—very carefully read.

Now, while our blade was not included in the list, we can read this article in a fairly unprejudiced frame of mind. You ask us what we think about it, and we can only reply that we think that some hack saw blade manufacturer or someone working in his interest has "put over" on you a beautiful page advertisement, as we can see no indication of a fair and unprejudiced test of blades from a careful perusal of this table.

R. D. BALDWIN,
Simonds Manufacturing Company, Advertising Manager.
Fitchburg, Mass., March 18, 1916.

In reply to the above letter, THE METAL INDUSTRY wrote as follows:

Attention of R. D. Baldwin, Advertising Manager.
SIMONDS MANUFACTURING COMPANY,
Fitchburg, Mass.

Gentlemen:—In reply to your favor of March 18 we should be very glad to have you give us your idea as to what would be a fair and unprejudiced test of hack saw blades.

The test that we published was certainly conducted in a most impartial way by Mr. Harper, as he was anxious to find the saw best adapted to his own use and there certainly was no intention of any hack saw manufacturer to "put something over on us," because, in the first place, the manufacturers knew nothing of any such test being made, and in the second place we had considerable difficulty in getting Mr. Harper to give us the results of the test to publish.

So the matter was entirely solicited as news by ourselves, and even the manufacturer of the saw which proved to be the best for Mr. Harper's purpose had no knowledge of any such test until they were informed of it by THE METAL INDUSTRY.

We should be glad to have you send us the test of your blades, so that it can be seen how they compare with others.

March 22, 1916. THE METAL INDUSTRY.

Mr. Baldwin then came back with the following:

To the Editor of THE METAL INDUSTRY:

Your letter of the 22d received. We do not question your sincerity in publishing the hack saw test and undoubtedly Mr. Harper did conduct the test in a most impartial way, but here is where the question of a proper saw test comes in. We know that when we began testing blades the first two or three or half-dozen attempts at what we considered an entirely impartial test proved to be worse than no test at all, because we did not get reliable information. It got down to a matter of tests running into two or three months' time and conducted in the most accurate and scientific way we could devise as a result of our experience in doing just this work.

Therefore we feel that we know not only just what our blade will do, but just what every other blade will do, and when we see a test which gives certain blades a good report and other blades which we know are first class a poor report, we know that there has been something wrong with the test. Either it has been made in a prejudiced way or has not been made as a result of long experience in testing blades, although testing a blade may seem a simple matter.

That is the way your printed test in January appealed to everybody in our organization immediately upon reading it. We have hundreds of test records of our blades, but would not want to print them along with the names of other blades, regardless of how good they show our blades. However, the writer feels that an article on the proper method of testing hack saw blades would be a very interesting article, but doubts if those who are actually doing the work and understand all the minute details would ever consent to put their experiences and methods into a written article.

R. D. BALDWIN,
Simonds Manufacturing Company, Advertising Manager.
Fitchburg, Mass., March 23, 1916.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE.

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

ALLOYING

Q.—Kindly advise us what aluminum alloy is generally used for the manufacture of aluminum automobile pistons.

A.—It can scarcely be said that there is a typical mixture of aluminum for making automobile piston castings. A number of manufacturers have been experimenting with the alloy of aluminum 93 and copper 7, but it is rather brittle. An alloy of aluminum 95, copper 4½ and aluminum vanadium ½ is recommended for this purpose.—J. L. J. Problem 2,275.

CASTING

Q.—We are having trouble in our foundry in the manufacture of small aluminum die castings. We use steel dies, with about 200 pounds air pressure over metal heated to 1,300 to 1,500 degrees. The castings are perfect on the outside, almost invariably, but all through under the skin they are full of small blow holes which render them useless. We have been using 95 per cent. virgin aluminum and 5 per cent. copper. Would you be kind enough to suggest the probable trouble?

A.—At the temperature of 1,300 to 1,500 degrees Fahrenheit your aluminum alloy will take up a large amount of gases which it holds in solution and gives out on solidification. These gases cause the blow holes. Quick melting and the use of a very small amount of some good deoxidizer will lessen your trouble—J. L. J. Problem 2,276.

Q.—Can you give us the following information regarding die castings? First—What is the effect of liquids on die castings made with a zinc base, will this contact corrode the metal? Second—Is a plunger intended to work with a snug fit into another casting, suitably made for the purpose, when it has a zinc base? Third—What is the effect of the contact with this plunger, made as above, when it comes in contact with liquid or soft soap?

A.—The more commonly used die casting alloys have a zinc base and contain varying amounts of copper and aluminum also. This puts them in the same class as commercial or impure zinc as far as corrosion is concerned. Pure zinc is not attacked by boiling water but it decomposes commercial zinc, hydrogen being evolved. Both pure and commercial zincs are attacked by the alkalies, the latter however being attacked the more readily.

If the component metals of a die casting alloy (copper, zinc, aluminum, etc.) are not well alloyed they may act as galvanic couples and thus greatly increase the rapidity of corrosion. Toilet soaps are supposed to contain no free alkali, but nearly all commercial soaps are seldom free from it. They also contain sulphates and chlorides that in a liquid soap would form an electrolyte that would be a cause of very marked corrosion under certain conditions.

Whether a die cast plunger would prove satisfactory in another casting would depend on the relative co-efficient of expansion of the two metals. Trouble has been experienced with die castings that have been bolted rigidly to brass plates in the case of apparatus exported to very hot countries. The co-efficient of expansion of the commonly used zinc base die casting alloys between 0° C. and 100° C. is about .0000280, while that of yellow brass is .0000180 for the same temperature range.—J. L. J. Problem 2,277.

DIPPING

Q.—We are using a mixture of two parts of nitric acid and one part of oil of vitriol for dipping bronze castings and drawn bronze material. We find that after using the acid for ten or fourteen days there is no more strength left in the acid. We would ask you to kindly advise us just what kind of a mixture to make up for bronze castings and drawn bronze so that it will last longer than the above stated time, and also let us know if our mixture is the best for dipping bronze. We would also like to know whether there is anything that would strengthen this acid mixture after it gets weak.

A.—We would advise you to use a mixture of 1 part of nitric acid (40 per cent.) and 1 part of oil of vitriol (66 per cent.) for dipping your castings. When the solution does not work you may add a little more nitric acid, but of course you must understand that even this will not make the solution last indefinitely as every time you dip the metal into it some copper is dissolved and the solution becomes charged with dissolved copper and, of course, in time the pickling qualities of the solution are dead.

When the solution becomes so charged with metal that it will not pickle the best thing to do is to make up a new batch and the copper may be recovered from the old solution by means of scrap iron or it may be crystallized as copper sulphate.—K. Problem 2,278.

DRILLING

Q.—We have some porcelain vases in which we wish to drill a half-inch hole and we should be pleased to have you inform us of the best method by which we may successfully accomplish this task without injuring the vases.

A.—To drill holes in porcelain vases use a twist drill with a point that is somewhat dull and run at a speed of about 300 revolutions per minute. Glycerine will be found an excellent lubricant to assist in going through the porcelain. Of course unusual care must be used and do not force the drill but let it gradually work through using a light pressure.

Sometimes sea sand and water is used. To soften the water a little washing soda is added.—C. H. P. Problem 2,279.

FINISHING

Q.—Please tell me how to get the finish on the samples I am sending you?

A.—The two shells submitted are made of Gildine metal. The embossed fine lines are accomplished by passing the soft metal in strips or coils, of the required diameter, through steel rolls, one roll engraved according to the design required. The pressure exerted upon the metal by screw pressure upon the rolls embosses the metal. The rolls may be run either by hand or by mechanical power. After the articles are formed up they are cleansed and bright-acid dipped; and then the stripe is produced by burnishing with the lathe burnisher. This is a simple operation, but requires experienced workmen to produce commercial results. The small shell is finished in the above manner. The finish on the large shell is termed ormolu. To obtain this dull finish, the shells after dipping are immersed in the dead dip, which consists of adding zinc, in the form of sheet metal, zinc sulphate, oxide or carbonate, to aqua fortis until a saturated solution is produced; then add one part of oil of vitriol to each two parts of aqua fortis used. A few moments' immersion produces the dead effect. The articles should then be washed and passed through the bright acid dip, washed and lathe burnished to produce the stripe as mentioned. Some little difficulty is experienced in producing a new dead dip. If the dip refuses to deaden, add a very little water; if too rough, add a little more oil of vitriol; if too smooth, add more aqua fortis. The bright acid dip should consist of:

Aqua Fortis	1 part
Oil of Vitriol	1 "
Water	¼ "
Common Salt	1 ounce to each gallon of mixed acids

—C. H. P. Problem 2,280.

MACHINING

Q.—We are machining brass and bronze bushings in large quantities, using four fluting drills for boring them out smooth and true. The packing or wedging of chips and the resultant heat cause much trouble, and we desire to know how we can avoid this difficulty.

A.—The difficulty of too much non-cutting surface in contact with the work is experienced mostly with internal cutting tools and particularly in brass and bronze work. In the latter case the material being worked becomes welded to the surface on account of the heat caused by the rubbing action of such a great amount of contacting surface. The form of cutting flute influences greatly the welding action and in some instances the spiral of the flute has an effect. The cutting edge should be radial.

Making the cutting edge slightly below center is sometimes recommended, as the chips then automatically work toward the center of the tool and are then forced out from the front of the hole being bored.—P. W. B. Problem 2,281.

MANUFACTURING

Q.—What is the regulation height of work benches used in brass manufacturing plants for chandelier and electric gas fixture work?

A.—The height of work benches usually varies from 32 to 36 inches from the floor to the top of the bench, the height depending somewhat on the nature of the work. For general purposes the height should be 34 inches. The width should be 30 inches and the top should be composed of heavy planks 2 inches thick in the front with lighter 1-inch boards in the back.

The thickness of the front planks is varied in accordance with the weight of the work which the bench is to be used for. Maple and ash are considered the best woods for bench planking. The position most suitable for benches, if used for fine accurate work, is the north side of a building, as the light is more even throughout the day.

The clearance space or gang way end of any projecting machine handles, handle wheels, etc., should not be less than 3 feet.—P. W. B. Problem 2,282.

MIXING

Q.—Will you kindly publish formulas for metals used in the manufacture of crucifixes and clock dials that will show up brightly when placed in the dark?

A.—There are a number of materials that glow in the dark. These bodies are usually phosphides such as calcium phosphides and the color of the light is modified by various additions, manganese giving an orange shade, zinc a bluish green, etc.

There is a material on the market—a radium luminous compound—which could be used for coating crucifixes, clock dials, etc.—J. L. J. Problem 2,283.

Q.—Kindly give us a good mixture for marine gong metal.

A.—For a good gong bell mixture we would advise you to try the following composition:

Copper	79.5
Tin	20
Zinc	1
Lead	.5

This mixture, when it comes from the crucible, will be approximately 79.5 copper and 20 tin and a little lead as the spelter will practically all burn out.

In making the mixture melt the copper, under charcoal, then carefully add the tin and then the lead, stir thoroughly and then add the spelter. Pour it at a good fluid heat after thoroughly stirring and skimming.—K. Problem 2,284.

Q.—We have been having considerable trouble in getting a phosphor bronze which is suitable for springs in the shape of ¼ of an inch wide and .030 of an inch in thickness. The material lacks uniformity and loses life after short usage. What non-ferrous metal, giving composition, would you recommend for this purpose?

A.—Spring temper phosphor bronze strip as made by the average maker contains from 3½ to 4½ of tin, a trace of phosphorus and the balance copper. The requisite temper is secured by cold rolling. The springs made from such material have a short eye because their elastic limit is due to the cold rolling rather than the composition.

It is possible to roll mixtures that run as high as 8 to 9 per cent. of tin. Such mixtures cast more and are more difficult to roll, but they give a bronze with a high elastic limit and furnish springs that will have a long life if properly made.—J. L. J. Problem 2,285.

PLATING

Q.—We have a large order for brass nose sockets used on 4.5 high explosive shells. The specifications call for them to be tinned or nickel plated without interfering with the thread. We are tinning them now, using a composition of 65 per cent. tin and 35 per cent. lead and having trouble with the metal adhering to the threads if the metal is not at the right temperature.

A.—You can send these nose pieces to a regular plating establishment and have them nickel plated, and it will cost less and also prove more satisfactory than the tinning process, as it will make the piece smooth and uniform and not adhere to the threads in places the same as the tin or interfere with the working of the thread, as the deposit will be smooth and uniform.—P. W. B. Problem 2,286.

SOLDERING

Q.—Can you give us any information about a solder with a low melting point? We have been using bismuth 8 parts, lead 4 parts and tin 4 parts.

A.—The only formulae that we could recommend to you for low melting point alloys which do not contain bismuth are as follows: Cadmium 2, tin 4 and lead 2, which melts at 300 degrees Fahrenheit, and lead 50, tin 35 and cadmium 22½ which melts at around 350 degrees.

As you do not say just what your limit of temperature is, although the alloy you mention that you are using melts at 212 degrees, we presume you do not want anything going over 212.

There are, of course, a number of alloys which contain both bismuth and cadmium which melt under 212, but we doubt if there would be much saving in using them as the cadmium is almost invariably substituted for more tin and as cadmium costs more than tin the alloy would be still more expensive.—K. Problem 2,287.

Q.—We would be pleased to have you advise us how we may solder britannia hollow-ware.

A.—Britannia hollow-ware should be soldered with a blow-pipe, as soldering-coppers are seldom, if ever, used for this purpose. The solder should consist of 2 parts of tin and 1 part of lead, the flux 1 part of glycerine, ½ part of denatured alcohol and ½ ounce of muriatic acid.

Care must be used in handling the blow-pipe flame so that the articles do not become over-heated or you will be liable to melt the articles. Move the flame to and fro until the melting point of the solder is obtained, then apply some of the flux and then the solder, which should be made in the form of wire or thin strips ⅛ of an inch.—C. H. P. Problem 2,288.

TARNISHING

Q.—Could you tell me if there is anything in a silver solution that will make the work tarnish. My silver solution consists of 3 ounces of chloride of silver, 10 ounces of cyanide of potassium and 1 gallon of water. Should not silver plated in a solution of that kind stand just as long without tarnishing as any other silverware which is not lacquered?

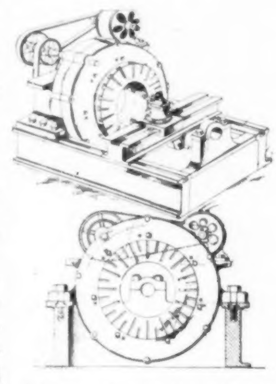
A.—There is nothing in the solution as outlined to make the work tarnish and it must be due to articles being wrapped in paper containing sulphur, or they are exposed to an atmosphere containing sulphur dioxide. We would advise that you look for the trouble beyond the plating room.—K. Problem 2,289.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST.

1,170,890. February 8, 1916. **Metal Working Lathe and the like.** George Gorton of Racine, Wisconsin.

This invention relates to certain improvements in lathes and more particularly to what are commonly known as facing lathes; and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawings.

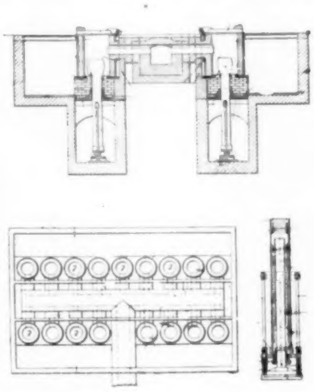


An object of the invention is to provide certain improvements in lathes, particularly lathes of the facing type, for the purpose of attaining maximum compactness with increased strength and durability.

A further object of the invention is to provide certain improvements in lathe headstocks and in the rotary face-plate-supporting-and-driving element mounted therein and carried thereby with the end in view of increasing lathe adaptability and efficiency.

1,171,500. February 15, 1916. **Crucible Furnace.** W. M. Brown, Johnstown, Pa.

This invention relates to the construction of crucible furnaces for manufacturing crucible steel and the invention is designed to provide a crucible furnace of improved construction, having novel means for handling the crucibles and for supporting the crucibles while in the furnace.



Another object of the invention is to provide a crucible furnace having improved means for supporting the crucibles with the bottom thereof above the level of the bottom of the crucible heating chamber.

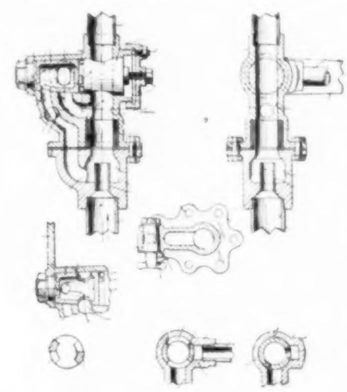
The invention further consists in the novel construction and arrangement of parts shown in the cut.

1,171,856. February 15, 1916. **Process for Making Compound Metallic Articles.** Irving Langmuir, of Schenectady, New York, assignor to General Electric Company, a corporation of New York.

The present invention comprises as a new manufacture metallic articles, such as plates, wire and the like, consisting partly of a metal of the iron group, particularly steel and an integrally joined coating of a malleable alloy of copper and aluminum. These articles combine the mechanical strength of iron or steel with the non-corrodibility, and attractive appearance of the alloy.

Because of the surface film of oxid forming on both the metal to be coated and the coating metal they cannot be integrally joined or welded by simply heating them in contact with each other, or even rolling, or hammering them in contact with each other. The invention includes a process whereby an intimate metallic union is secured.

1,172,008. February 15, 1916. **Controlling Device for Sand-Blast Apparatus.** Frederick A. Coleman, of Gates Mills, and David S. Hawkins and Albert J. Farrell, of Cleveland, Ohio, assignors to the Coleman Foundry Equipment Company, of Cleveland, Ohio, a corporation of Ohio.



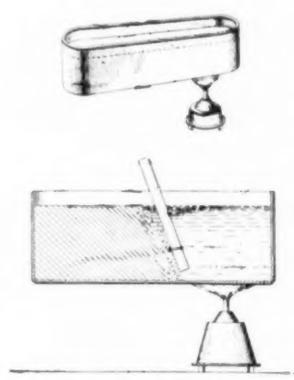
This invention is for a device for controlling the flow of sand and air in a sand-blast apparatus.

An object is to provide a device by which the flow of sand and air may be controlled, as shown in cut, from one point and in a very simple manner, thus avoiding the use of the usual plurality of inconveniently separated valves for controlling the sand-blast apparatus.

Another object is to so arrange the device that the flow of sand from the reservoir may be controlled by a valve controlling the air to counteract the pressure on the sand in the sand conduit, and so arranged that the counteracting air may be directed by such controlling means to clean out the hose and a valve in the sand-blast passage before the closing movement of this valve is started.

1,172,160. February 15, 1916. **Aluminum Plating Process.** Frederick Moench, of Rushville, Illinois.

This invention relates to improvements in processes of plating aluminum, and it consists in the steps hereinafter enumerated.



An object of the invention is to provide a process for plating aluminum with tin, lead, zinc, or alloys, of the same which may be carried on in an economical manner and with very simple apparatus.

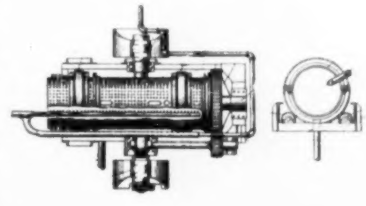
A further object of the invention is to provide a process of plating iron or other metals with aluminum, as shown in cut.

A further object of the invention is to provide a process of the type described which may be carried out without the use of brushes or instruments for scratching or rubbing the aluminum.

A further object of the invention is to provide a process of the type described, which may be conducted with a minimum amount of heat.

1,174,975. March 14, 1916. **Tumbling-Barrel.** James M. G. Fullman, of Sewickley, Pa., assignor to National Metal Molding Company, of Pittsburgh, Pa.

This invention relates to tumbling-barrels, structures in which articles are caused to strike one against another and against the sides of the barrel itself, to effect sometimes cleaning, sometimes abrading, and sometimes other ends. The patent includes the following claims:



In a cleaning apparatus a tumbling barrel of essentially cylindrical form mounted in a suitable frame said tumbling-barrel being divided medially and longitudinally, and provided with an enlarged zone in its cylindrical

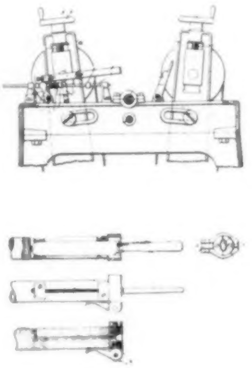
walls and supporting rollers in said frame engaging such enlarged zone.

A cleaning apparatus, shown in cut, including the combination of a perforate rotary tumbling-barrel having one side removable, and a compressed-air nozzle mounted on a support external to said barrel, and capable of being swung when the side of the barrel is removed to and from operative position within the barrel.

1,175,332. March 14, 1916. **Grinding and Polishing Machine.** John Aubrey, Hartford, Conn.

This invention relates to a machine that is adapted to grind and polish articles that are oval in transverse section, such as cutlery handles.

The object of the invention is to provide a simple and cheap automatic machine of this class, as shown in cut, into which table knives or like articles with metal or wooden handles may be readily placed, and have their handles quickly ground and polished as satisfactorily as if they were presented and held to the grinding and polishing medium by hand.

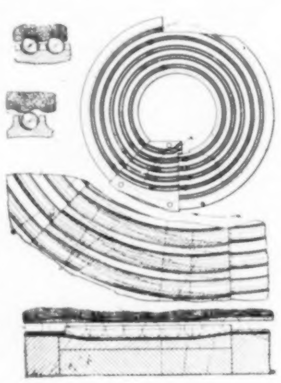


While the invention may be embodied in machines for grinding as well as polishing articles, as it is particularly valuable when embodied in machines for polishing knife handles, it is herein described as designed for such purpose. In attaining this end the machine is provided with a slow rotating spindle having a chuck into which a knife blade may be readily thrust and clamped with its handle projecting, and the abrading material is applied to rapidly traveling endless belting, which is moved into engagement with the handle of the knife held by the chuck.

1,176,099. March 21, 1916. **Grinding Machine.** Albert F. Rockwell, of Bristol, Conn., assignor to the New Departure Manufacturing Company, of Bristol, Conn.

This invention relates to grinding machines, and is particularly applicable to those machines for grinding balls in which the balls traverse a series of grinding grooves which are connected by transfer grooves.

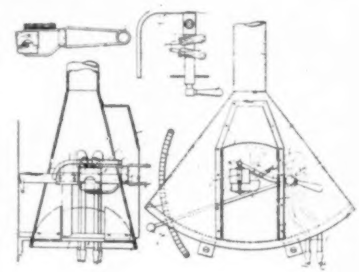
Heretofore it has been customary to provide ball grinding machines with a suitably supported stationary guide disk, and a co-operative, rotative abrasive disk, said disks having a concentric series of matching grooves in which the balls are received and ground, the said guide disk also having transfer grooves, each of which extends across the line of a rib of the abrasive disk, and connects one grinding groove with the next, whereby each ball takes an orderly course through all of the said concentric grinding grooves, and traverses the same path traversed by each other ball, thus securing uniformity of product. In such machines it has been customary to provide the said guide disk (or its transfer plate) with fingers or like deflectors, which obstruct the said grinding grooves and carry the balls into the transfer grooves, whereby during either the whole or some considerable portion of the length of each transfer groove a ball is wholly out of control of and out of contact with the said abrasive disk.



The object of the machine shown in cut is to reduce the cost of such machines, provide for smoother and more even travel of the balls through the machine, provide for increased grinding action, and secure continuity of the grinding action.

1,175,627. March 14, 1916. **Jewelers' Melting Apparatus.** W. H. Ford, Lowell, Mass., assignor of one-half to F. Hanchett of the same place.

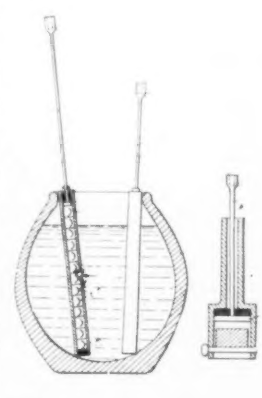
In the manufacture of jewelry it is necessary to regulate the amount and extent of heat applied to the particular metal, mass or amalgam or alloy employed in each particular batch with great care and nicety, and it is an important object of the present invention to provide simple and efficient means for such regulation.



It is also an important feature of the present invention to provide means, as shown in cut, to hold a crucible, so as to permit automatic adjustment of the crucible with relation to the heat applied thereto; and furthermore, to so arrange such automatic means that the crucible will be substantially level at all times, and will eliminate any danger of losing any of its contents during the melting operation, as well as during the various adjustments.

1,176,655. March 14, 1916. **Aluminum Alloys.** W. N. Naylor, Forest Hill, London, and S. P. Hutton, Beckingham, England.

This invention relates to aluminum alloys, and has for its object to provide an improved alloy or alloys, and a process or processes for making same.

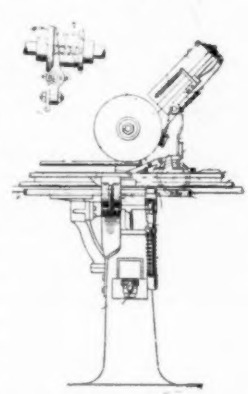


One alloy made in accordance with this invention and adapted for use in sea-water is made in the following proportions by weight: 1½ pounds aluminum, 1¼ ounces magnesium, 3 grams phosphor tin, 2 grams phosphorus. This may be varied for a drawing mixture as follows: 4 pounds aluminum, ½ ounce magnesium, 2 grams phosphor tin. For increased tensile strength the alloy may be varied as follows: 1½ pounds aluminum, 1¼ ounces magnesium, 1¼ ounces phosphate copper, 3 grams phosphor tin. For dental purposes it may be varied as follows: 4 pounds aluminum, ½ ounce magnesium, 1 gram phosphor tin, 2 grams metallic sodium.

An alloy such as above referred to may be prepared by the apparatus shown in cut.

1,176,139. March 21, 1916. **Polishing and Buffing Machine.** John F. Gail, Kenosha, Wis.

This invention relates to improvements in polishing and buffing machines and refers more particularly to a machine, shown in cut, which is used for polishing and puffing brass tubing, such as is used in brass beds or other metal furniture and the like, the polishing and buffing being accomplished by the same machine without removal of the tubes.



Among the salient objects of the invention are to provide a construction in which a series of tubes is simultaneously and automatically polished and buffed at the same setting of the machine, the machine being so organized as to insure a uniform polishing and buffing of the respective tubes; to provide in a construction of the character referred to improved means for supporting and reciprocating the tubes back and forth beneath a revolving polishing wheel for a given number of reciprocations.

EQUIPMENT

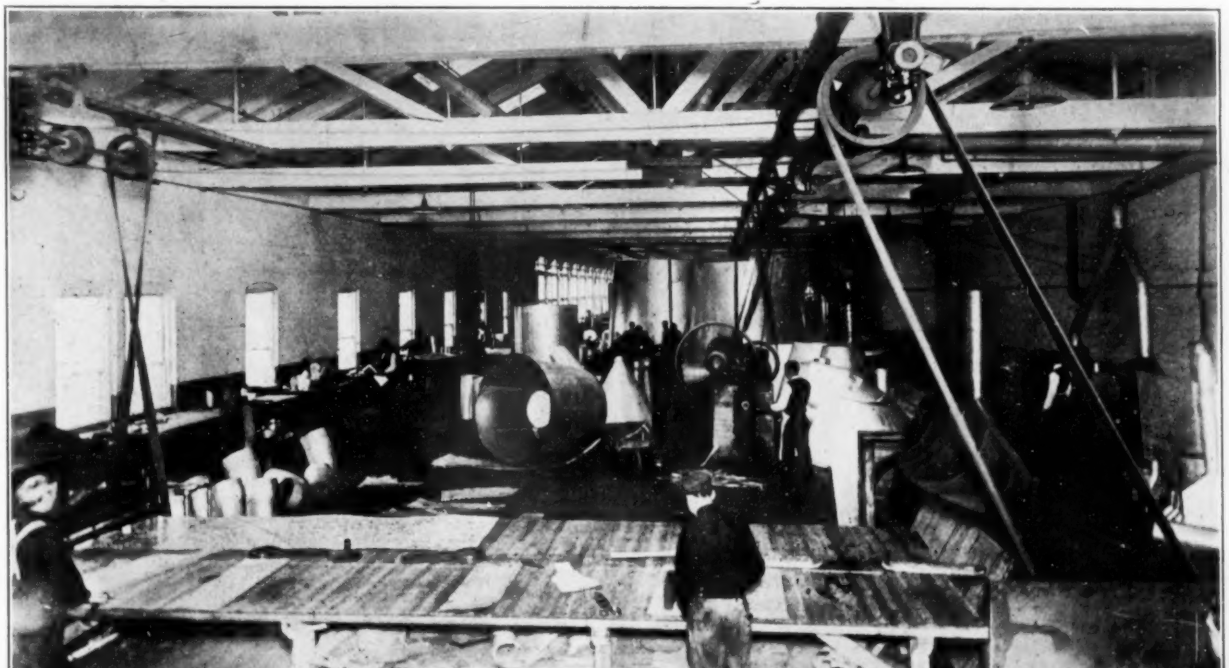
NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST.

STERLING BLOWER COMPANY

The Sterling Blower Company, of Hartford, Conn., has recently acquired a new plant on upper Windsor street, in that city. Owing to their increasing business the company found it necessary to seek larger quarters. The plant, one of the largest of its kind in New England, is located on the main line of the New York, New Haven & Hartford Railroad. The general office and engineering department occupy commodious quarters finished off in white and gray enamel. The office supplies and records of the company are kept over the office on the second floor. In the rear of the office is the sheet metal department provided with an abundance of light and air and equipped with machinery designed to easily work steel sheets up to the heaviest gauges. On the east side of this department there is a long room divided into sections in which are located a modern machine shop, boiler room, shipping and stock rooms. On the north side of the plant a large blower room is located in which blowers of all kinds and descriptions are manufactured. Other buildings about the plant include the blacksmith shop and lumber sheds. A spur track enters the plant from the north end and runs the entire length of the factory which makes it very convenient for shipping and receiving goods. The company has also acquired a large plot adjoining the plant which can be used to facilitate further expansion. The officers are George W. Christoph, president and treasurer; Robert A. Briggs, secretary; W. J. A. London, works manager.

The Sterling Blower Company make a specialty of blowers for factory ventilation, and also for use in the elimination of dust from the air of the workroom. The apparatus of this company is to be found in all parts of the country, and the new buildings are substantial evidence of the magnitude of the business. A comprehensive catalogue will be sent upon request.

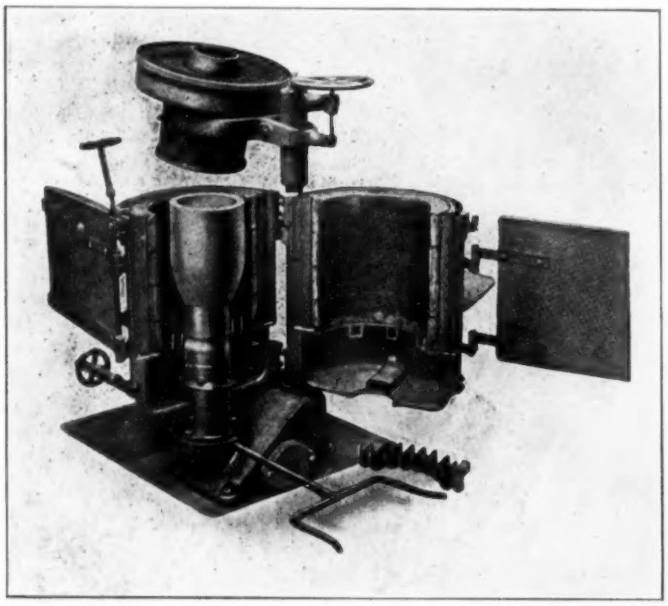
THE NEW PLANT OF THE STERLING BLOWER COMPANY AT HARTFORD, CONN.



A VIEW OF THE GENERAL MANUFACTURING ROOM OF THE NEW PLANT OF THE STERLING BLOWER COMPANY, AT HARTFORD, CONN

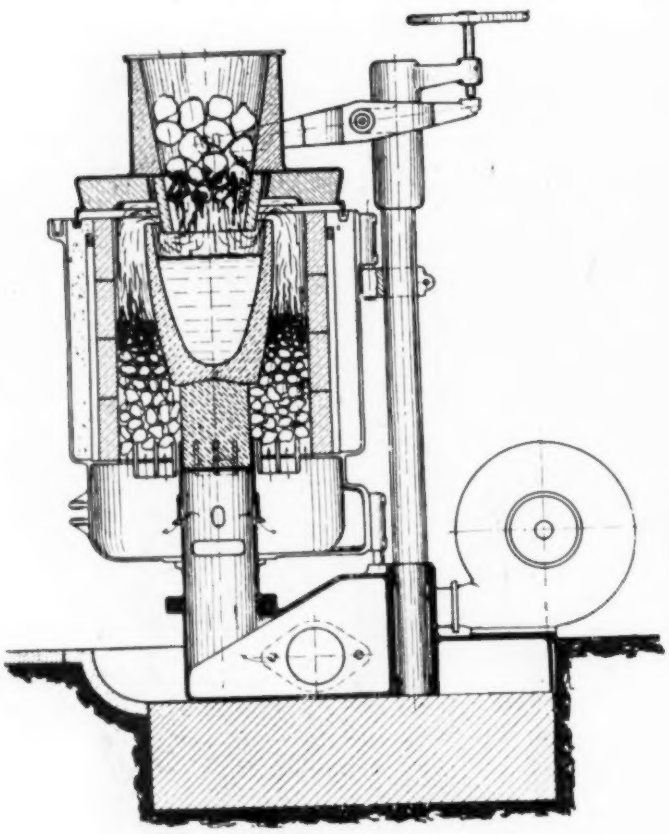
CRUCIBLE FURNACES

The furnaces shown in the accompanying illustrations are manufactured by R. & G. Hislop, gas and heating engineers, Underwood House, Paisley, England. As will be noticed in the pictures some notable advantages may be claimed for these fur-



THE HISLOP FURNACE, OPEN.

naces, among which are: no crucible tongs required; no special chamber or pit in the floor, as the furnace is portable and can be placed almost anywhere; ordinary gas coke is employed



PLAN VIEW OF THE HISLOP FURNACE.

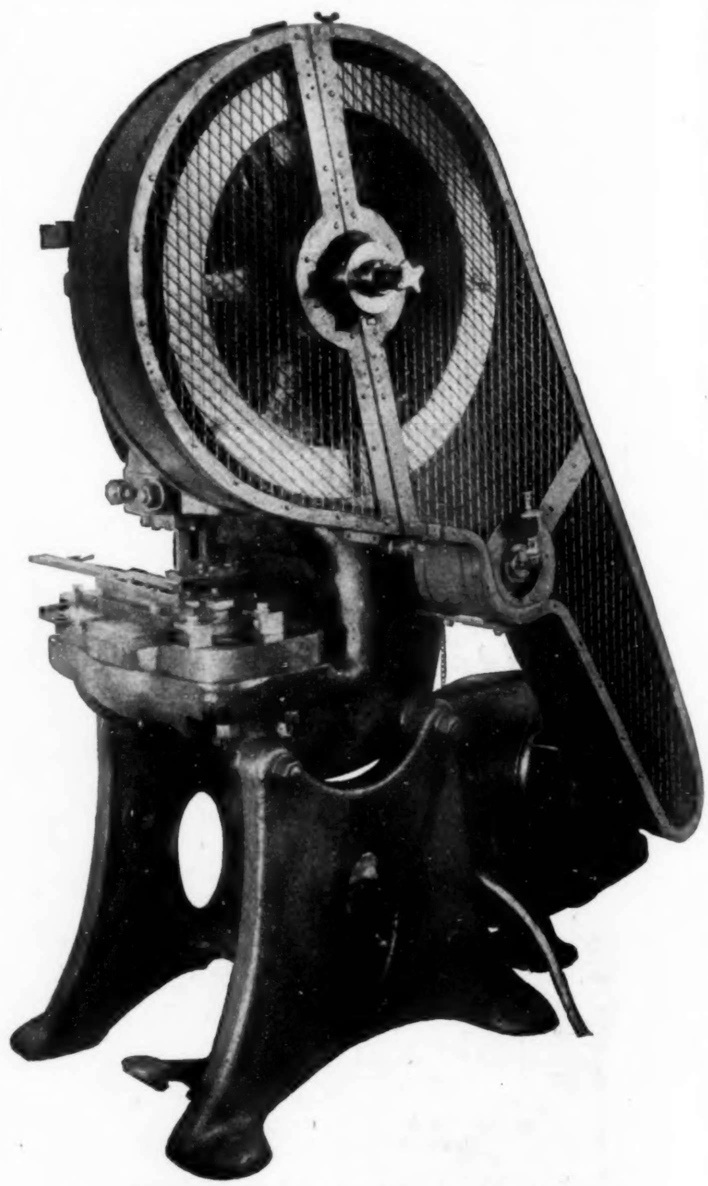
and there being no parts to get out of order, it makes it extremely simple to handle the furnace.

These furnaces are made in five different sizes, taking crucibles holding from a hundred to seven hundred pounds of metal. Some results of tests made with a 240-pound furnace are given by the manufacturers as follows: 35 minutes are required to melt first heat, 25 minutes to melt the subsequent heats, 30 to 35 heats were obtained per crucible and 14 to 16 heats of metal were made per day of 10 hours, giving a production of from 3,000 to 3,400 pounds of brass melted in 10 hours.

SAFETY FIRST GUARDS

The illustration shows a punch press equipped with a belt guard. This belt guard is manufactured of material called steelcrete, which is the product of the Consolidated Expanded Metal Company, the Expanded Metal Engineering Company, Park avenue and 40th street, New York, N. Y., general agents.

It is claimed for these steelcrete guards that they do not obstruct the light when used to form an enclosure and consequently



STEELCRETE GUARD AROUND A METAL PRESS.

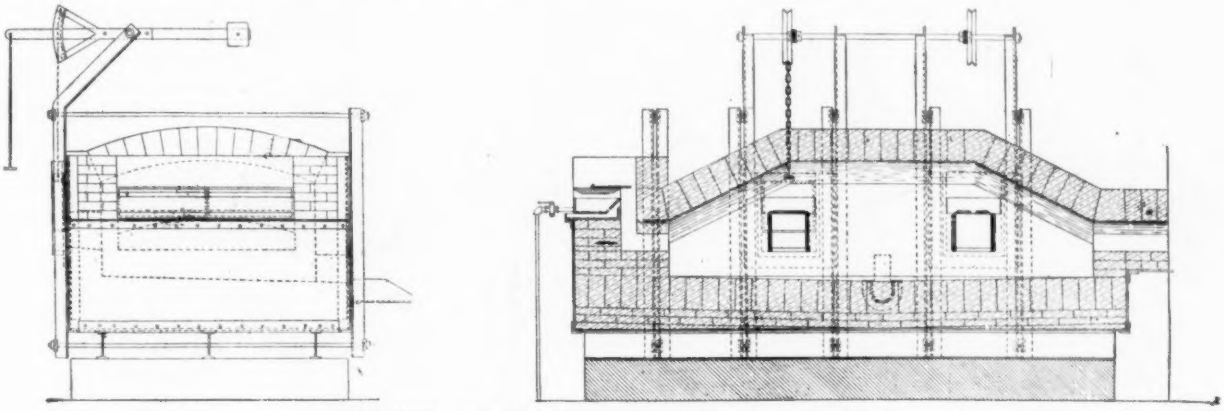
there is no loss of efficiency in the operation of the machine. Steelcrete mesh, as shown in the cut, is being used to build partitions for tool rooms and shops, tool racks, window guards and small partitions in shelves. Steelcrete is carried in stock in standard size sheets, of which one sheet will make one or more guards. A complete list of sizes of sheets carried together with very interesting illustrations showing the applications of steelcrete mesh are contained in a catalog issued by the company, which may be had free of charge.

OIL REVERBERATORY FURNACE

The furnace whose construction and design is shown in the accompanying cut is, it is stated by the manufacturers, now being successfulyy used for smelting and refining or otherwise treating copper, silver, nickel and other metals and alloys. These furnaces have been built with a capacity of from 500 to 70,000 pounds and employing temperatures up to 4,000 degrees Fahr., and it is now claimed that the furnace is no longer an experiment but a practical and economical working appliance. The operation of the furnace is as follows:

A shallow vessel or pan is filled with oil, and the surface set afire, producing a rich hydrocarbon gas, this, being drawn inward by the natural draft of a chimney, is carried between two currents of air, also induced by the stack, into the narrow passage, where it is thoroughly mixed and perfect combustion results. The novel feature of this appliance is the method of, and the control of the air to the gas flame. Heretofore the air was not under control, and the result was incomplete combustion and carbon deposits clogging the passages. With their patented system the makers state that they have no deposits, get higher heats, and have full control of the flame and temperatures. The temperature is controlled by the changing of the air inlets and also by the cold air inlet in the escape flue, reducing the draft, but providing always an even amount of heat.

It is stated that the draft necessary for good results in the operation of this furnace is very light and that no trouble has been experienced in handling oxides that have passed a thirty mesh screen and even finer. As to the economy it is claimed that this furnace saves from ten to twenty per cent., as five per cent. is saved in the use of steam ordinarily used for spray, five per cent. saved due to the absence of the chilling effect of steam on the combustion chamber and the balance is due to better combustion and steady mixture.



THE NEW OIL-FIRED REVERBERATORY FURNACE.

This furnace is noiseless and cooler for the operator and repairs are said to be lower than on other types.

The furnace is manufactured by the Oil Furnace and Engineering Company, 60 Liberty street, New York. Among the recent users of this furnace may be mentioned the Munning-Loeb Company, Matawan, N. J., United States Nickel Company, New Brunswick, N. J., International Nickel Company, Bayonne, N. J., and Apothecaries Hall Company, Waterbury, Conn., whose great demand for nickel anodes has made it necessary for them to increase their capacity are now having one of these furnaces installed. Further information concerning these furnaces will be gladly furnished by the manufacturers.

AUTO-PNEUMATIC ACTION COMPANY GIVES SUGGESTION PRIZES

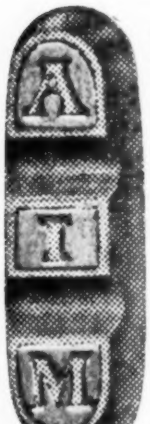
THE AUTO PNEUMATIC ACTION COMPANY AWARDING PRIZES FOR MERITORIOUS SUGGESTIONS.

In the photograph, seated in the front row, from left to right, will be seen the young man in shirt sleeves, who won the Grand Prize for the best suggestion made throughout the industries. The next man is foreman of Department H of the Company, which Department took the greatest number of prizes throughout the year, and were consequently, awarded the beautiful pennant shown in the foreground of the picture. Mr. Thomas Danquard, vice-president of the Company, and also general superintendent, is next seen and seated next to him is Mr. Wm. J. Barton, secretary of the Company. Mr. E. Stevenson, one of the assistant superintendents, is next, and seated at the right end in the front row, is President Wm. J. Keeley. The two men at the left, in the second row, were winners of the Monthly Prizes, for submitting practical suggestions.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS.

AMERICAN INSTITUTE OF METALS



President, Jesse L. Jones, Pittsburgh, Pa. Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 106 Morris avenue, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities as invited. The 1916 convention will be held in Cleveland, Ohio.

W. M. Corse, secretary, reports that the new official emblem of the American Institute of Metals, which is made to represent a miniature ingot, can be obtained on application to him at his address, 106 Morris avenue, Buffalo, N. Y. The pin is made with safety catch and with blue enamel for active members and red enamel for associate members. The prices of these emblems are for gold filled, $1.00, and for solid gold, $3.00.

There will be a joint meeting of the various societies that form the Bureau of Standards Advisory Committee on April 27, 1916, at Washington, D. C. A committee representing the American Institute of Metals will meet with this Bureau and will consist of the following members: William B. Price, Waterbury, Conn.; Dr. William Campbell, New York City; W. H. Bassett, Waterbury, Conn.; W. R. Webster, Bridgeport, Conn.; G. H. Clamer, Philadelphia, Pa.; W. M. Corse, Buffalo, N. Y.; F. L. Antisell, Perth Amboy, N. J.; D. B. Browne, New York City; Prof. H. O. Hofman, Boston, Mass.; Dr. J. W. Richards, South Bethlehem, Pa.; George C. Stone, New York City; Charles R. Spare, Holmesburg, Philadelphia, Pa.; and Jesse L. Jones, Pittsburgh, Pa.

Secretary Corse states that the topics which will probably be discussed are test bars of government gun bronze, molding sands, standard analyzed brass samples, various failures of bronzes and brasses under special conditions.

AMERICAN FOUNDRYMEN'S ASSOCIATION

The committee appointed at the last annual meeting of the American Foundrymen's Association to confer with the United States Bureau of Standards, Washington, D. C., on problems in which it was decided the bureau could help the foundrymen met recently at the bureau. Matters of common interest were discussed at length. The bureau was urged to undertake investigations looking to the establishment of a standard molding sand. Other matters considered were facing of sands, core-binder standards, standard sieves, and shock and other suitable mechanical tests of malleable castings.

It is interesting to note that, in view of the fact that the coming exhibition of foundry supplies and equipment at Cleveland, Ohio, next September, which, as has been previously mentioned, will be held under the auspices of the foundry associations, the American Foundryman's Association has decided to incorporate and therefore the name of the association will be in the future the American Foundrymen's Association, Inc.

St. Louis, Mo., Foundrymen's Club.—At the annual meeting all officers were re-elected for the next year as follows: H. S. Gulick, president, More-Jones Brass & Metal Co.; Thomas H. Smith, vice-president, Washington University; W. C. Roepke, treasurer, Commonwealth Steel Co.; C. Roy Rook, secretary, U. S. Incandescent Lamp Co.

AMERICAN ELECTRO-PLATERS' SOCIETY

(AN EDUCATIONAL SOCIETY.)

President, W. S. Barrows, Toronto, Canada; Secretary-Treasurer, Walter Fraine, 507 Grand Ave., Dayton, Ohio. All Correspondence should be addressed to the Secretary. The objects of this society are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. The Society meets in convention in the spring of each year, subject to the decision of the executive committee. The next convention will be held at Toronto, Canada. The branch associations hold monthly and semi-monthly meetings in their various cities.

St. Louis Branch—F. C. Rushton, secretary, 4405 Blair avenue, St. Louis, Mo.

At the last regular monthly meeting of this branch it was decided to ask the following question, which it was hoped the members would be sufficiently interested enough in to answer. What is the best form and formula for a nickel anode that would give as sufficient service as the anode used in the duplex copper solution?

New York Branch—William Fischer, secretary, 345 East 23rd street, New York, N. Y.—President Reama presided at the regular monthly meeting of the New York Branch which was held on Friday evening, February 25. The banquet committee reported that the banquet held on February 19 was both a social and financial success and a note of thanks was extended to the exhibitors and all those who assisted in making it a success. Two applications for membership were received. The subject for the evening was the cause of blistering on iron or steel in a cyanide copper solution and the subject for the next meeting, March 10, will be nickel plating.

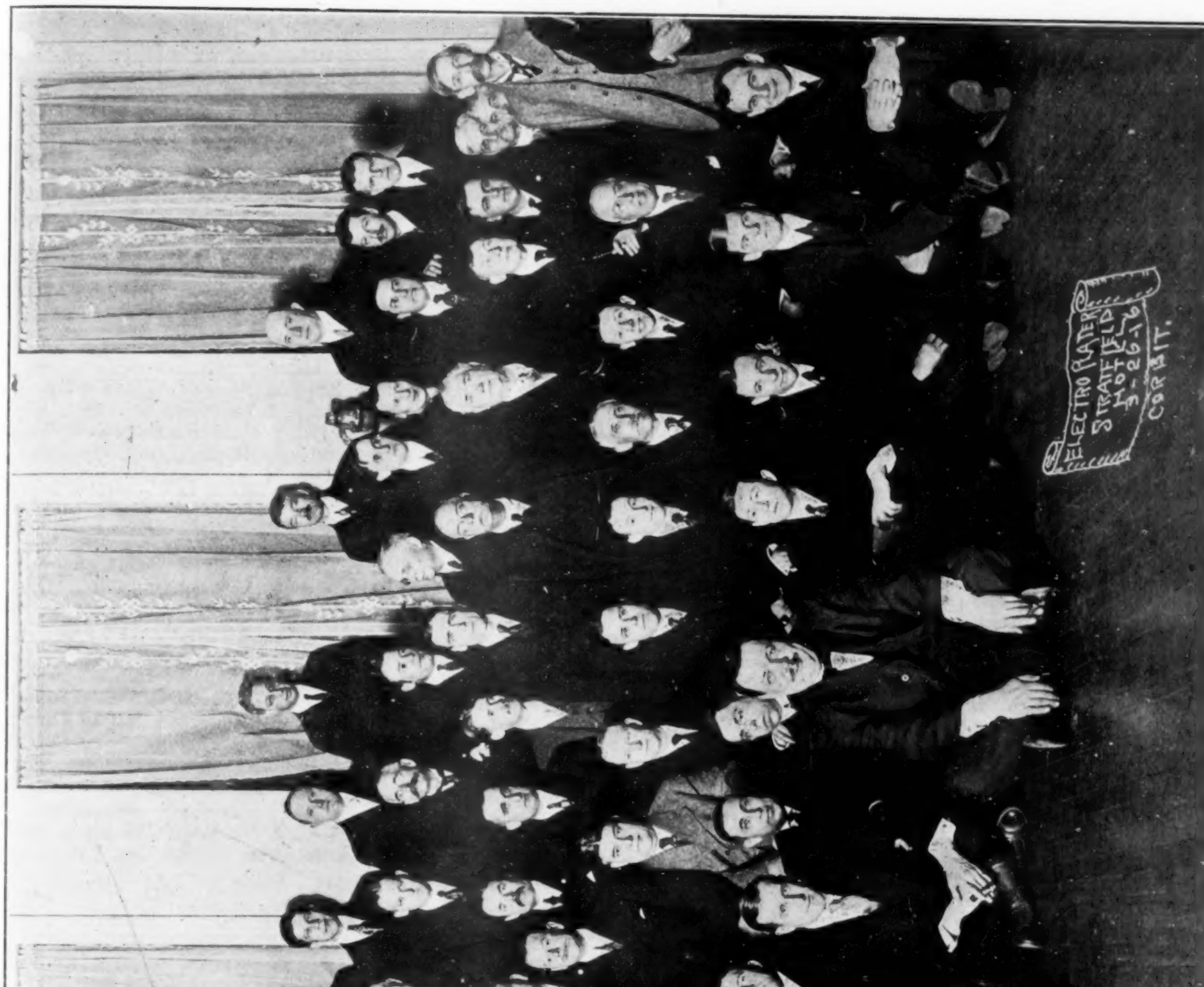
Toronto Branch—E. Coles, secretary, Box 5, Coleman P. O., Toronto, Canada.

This branch held a very successful meeting on February 24. Secretary Coles reports that with the re-adjustment and settling down of business generally the branch has once more started to expand and has a membership that extends throughout the Dominion from Dartmouth, N. S., to Vancouver, B. C. He invites any plater who may contemplate becoming a member to correspond with him for information regarding the association.

Plans for the convention to be held in June are going forward rapidly, but, as mentioned elsewhere, it may be deemed advisable to transfer the convention from Toronto to Niagara Falls, N. Y.

Bridgeport Branch—N. A. Barnard, 858 Howard Avenue, Bridgeport, Conn.

The third annual banquet of the Bridgeport Branch was held at the Hotel Stratfield, Bridgeport, Conn., on Saturday evening, March 25. The attendance was very much larger than that of last year's banquet, there being more than one hundred members and their friends present. A very enjoy-



THE MEMBERS OF THE BRIDGEPORT (CONN.) **BRANCH** OF THE AMERICAN ELECTRO-PLATERS' SOCIETY AND THEIR FRIENDS, ASSEMBLED FOR THEIR SECOND ANNUAL **BANQUET AT** THE HOTEL STRATFIELD, BRIDGEPORT, CONN., MARCH 25, 1916.

able and profitable evening was spent and interesting addresses were made by W. R. Webster, vice-president, of the Bridegport Brass Company; Dr. F. C. Stanley, of the Bridgeport High School; Charles H. Proctor, founder of the society; S. J. Slawson, superintendent of the Bridgeport schools, and George B. Hogaboom, former president of the society.

It was announced at the banquet that the question of transferring the place at which the annual convention will be held in June from Toronto, Canada, to Niagara Falls, N. Y., is under consideration, and that it was quite possible the change would be made.

It was also reported that a branch had been organized at Providence, R. I., with about twenty-five members and that a temporary charter had been issued by the Supreme Society.

AMERICAN SOCIETY FOR TESTING MATERIALS

The American Society for Testing Materials will hold its nineteenth annual meeting at Atlantic City, N. J., June 27 to July 1, inclusive, with headquarters at the Hotel Traymore.

Notwithstanding the increase in dues, the resignations from membership in January, 1916, that is, since the beginning of the current fiscal year, have shown no significant increase. The total present membership, after deducting these resignations, is 1940, as compareed with a total membership of 1842 reported at the last annual meeting.

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS

The spring meeting of this association was held at the Hotel La Salle, Chicago, Ill., March 22 and 23. Commissioner William M. Webster reports that the following resolutions were adopted:

On all orders shipped by parcel post or express, the minimum charge for merchandise be 15 cents and a proper charge which shall include the amount of actual postage, or expressage; a charge for insurance of delivery of the package and service covering the labor and expense incident to all parcel post and express shipments.

That on direct shipments to points other than the customer's home address, no freight allowance will be made.

When orders have been correctly filled, we cannot allow the return of goods, unless a full explanation has been made and our consent obtained. If accepted, all goods returned in a salable condition—so they may be sold as new goods—will be credited at not less than ten per cent. for service and rehandling charge, plus shipping expenses.

That the policy of allowing reverse telephone charges and charges on "collect" telegrams is a bad one and contrary to the interests of the business and will not be permitted.

The following is a partial list of the members and guests who were present: American Foundry & Manufacturing Company, St. Louis, Mo.; Atlas Brass Manufacturing Company, Cleveland, O.; Burlington Brass Works, Burlington, Wis.; Central Brass Manufacturing Company, Cleveland, O.; Cochrane Brass Manufacturing Company, Cleveland, O.; Chicago Faucet Company, Chicago, Ill.; Dick Brothers, Reading Pa.; Edwardsville Brass Company, Edwardsville, Ill.; Empire Brass Manufacturing Company, Cleveland, O.; Glauber Brass Manufacturing Company, Cleveland, O.; Hayes Manufacturing Company, Erie, Pa.; The Haydenville Company, Haydenville, Mass.; Hoffman & Billings Manufacturing Company, Milwaukee, Wis.; A. Y. McDonald Manufacturing Company., Dubuque, Ia.; McShane Bell Foundry Company, Baltimore, Md.; Milwaukee Brass Manufacturing Company, Milwaukee, Wis.; H. Mueller Manufacturing Company, Decatur, Ill.; Northern Brass Company, Waukegan, Ill.; Peck Brothers & Company, New Haven, Conn.; Rickersberg Brass Company, Cleveland, O.; Royal Brass Manufacturing Company, Cleveland, O.; Rundle-Spence Manufacturing Company, Milwaukee, Wis.; J. J. Ryan & Company, Chicago, Ill.; Roberts Brass Manufacturing Company, Detroit, Mich.; Street & Kent, Manufacturing Company, Chicago, Ill.; Speakman Supply & Pipe Company, Wilmington, Del.; Standard Sanitary Manufacturing Company, Pittsburg, Pa.; E. Stebbins Manufacturing Company, Springfield, Mass.; United Brass Manufacturing Company, Cleveland, O.; Union Brass & Metal Company, St. Paul, Minn.; Victor Brass Company, Cleveland, O.; L. Wolff Manufacturing Company, Chicago, Ill.; Wolverine Brass Works, Grand Rapids, Mich.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST.

Albert F. Rockwell was re-elected president of the Bristol Brass Company and the American Silver Company, Bristol, Conn., at the annual meetings of the two companies, February 29. All the fomer directors and officers were also re-elected.

W. J. Reardon, for many years superintendent of the foundry of the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., on April first assumed the superintendency of the brass foundry of the Rome Manufacturing Company, Rome, N. Y.

E. L. Goldschmidt and C. P. Lyman, for a number of years with the Waclark Wire Company, New York City, have resigned and formed a company under the name of Goldschmidt & Lyman, Inc., to conduct a brokerage business in raw metals and manufactured metal products at 90 West street, New York City. Mr. Goldschmidt will handle the raw metal end of the company's business, having had many years' experience in that field, and Mr. Lyman having to do with manufactured metal products.

DEATHS

Announcement has been made of the death, March 10, 1916, at his home in St. Louis, Mo., of H. T. Healy, a member of the St. Louis, Mo., branch of the American Electro Platers' Association.

JOHN WATSON

John Watson, many years owner of the John Watson & Sons Company, Inc., manufacturers of machinery and brass, died on March 14 at his late home, 330 South Warren street, Trenton, N. J. Death was due to asthma. He was eighty years old.


JOHN WATSON.

Mr. Watson started the first machine and brass establishment in Trenton, opening his plant fifty-two years ago on Fair street. He conducted the plant at the time of his death. Mr. Watson built the first automobile in this section, operating the old-fashioned car in 1900. He was also an inventor and several of his patents are now in use in the Edison plant at Schenectady, N. Y.

Mr. Watson was born at Perth Amboy, N. J., September, 1836. While working as a fireman on the old Camden & Amboy Railroad his mind was attracted to the construction of the engine and he determined to learn the machinists' trade.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS.

NEW BRITAIN, CONN.

April 3, 1916.

Improved business conditions in the metal manufacturing line continue to be the salient feature of the industrial life in New Britain. In all of the factories, large and small, there is no dearth of orders and hence few men need want for honest employment if they seek it. But while everything seems bright, still the manufacturers cannot help but feel a twinge of uneasiness as the spring approaches when they recall the labor troubles of last fall and the threats of another strike this spring. This fear is further strengthened by the active campaign that is being inaugurated here among the skilled mechanics for better working schedules. For some time it has been the consensus of opinion that the New Britain Machinists' Union would present to the local manufacturers in the spring a demand for an eight-hour day and recognition of the union. This matter is made clear when Organizer John F. Quinn of the local branch affirms the report. He told The Metal Industry writer that the demands would be presented early in May. It is claimed that the union has about 200 men enrolled. Already the union is beginning its campaign by having open meetings and even shop-door lectures, all booming the eight-hour schedule and demanding its recognition. In the various factories the manufacturers are silently working against this plan. It is reported their plan of campaign is to approach various employes individually and quietly increase their pay, hoping thus to satisfy enough so that should a crisis come they would not be left in the lurch. However, that a serious labor strife this summer is not entirely unthought-of is shown by the fact that the police department has been increased by ten men with a view to emergencies.

Its business ever on the increase, the Stanley Works is today one of the city's busiest plants. Two large frame structures are being added to its factory. One will be 140x55 feet and will cost $2,000; the other will cost $1,200 and the measurements are 140x20 feet. At the New Britain Machine Shop business conditions are unusually good and large quantities of machines and machine parts are being turned out each week. The Union Manufacturing Company, said to be one of the best organized concerns in the city, is also booming. A large factory addition will be ready for occupancy shortly. Recently the men have been placed on a bonus rate and now the order comes that preparations are being made to run at least a part of the factory on a night and day shift in order to keep up with the rising tide of business. All other concerns, including the various branches of the American Hardware Corporation, Landers, Frary & Clark and allied plants, the North & Judd Manufacturing Company and Traut & Hine are doing well. The Fafnir Bearing Company, makers of ball bearings of all sorts, are doing a rushing business and cater extensively to the automobile trade.

But while orders are pouring in and products are being turned out rapidly, the New Haven road freight embargo is causing the manufacturers no end of trouble. Freight traffic is tied up in this state and it is extremely hard to send out shipments or to receive any. As a result of this embargo the Bristol Brass Company, one of the busiest brass mills in the East, has been obliged to shut down several days because of inability to get rough stock. This mill has more orders on its files than can be handled, yet is being hampered by lack of stock with which to work. Other concerns are being injured in various degrees.—H. R. J.

HARTFORD, CONN.

April 3, 1916.

Despite their struggles with the difficulties presented by the tie-up of Connecticut River navigation, freight congestion and a protracted winter season, the constituents of Hartford's metal industry are busier to-day than they have ever been since the beginning of the European war put an abrupt end to a period of comparative inactivity. The production is greater than ever before and will become even greater, according to conservative predictions; factory additions are being rapidly built, and there is a clamor for at least 500 more skilled hands at once. All this may be attributed indirectly to the war, but the activity is confined entirely to old-established concerns. Not a single industry has sprung up in Hartford for the sole purpose of filling war orders, but those that have been operating here for many years have been obliged to expand in order to care for the increased business which the past year has ushered in. It is conservatively estimated that at least 4,000 more mechanics came to Hartford during 1915 and that an equally large number may be expected during the present year.

All strikes of the machinists which have been in progress in this city, with the exception of that at the Capewell Horse Nail Company, which is now about a year old, were declared off by the executive board of Capitol City Lodge, No. 354, about the middle of last month. The following shops were put back on the "fair" list, in accordance with directions from the executive board of the International Association of Machinists: Pratt & Whitney Company, Hart & Hegeman Manufacturing Company, Taylor & Fenn Company, Arrow Electric Company, Jewell Belting Company, Rhodes Manufacturing Company, Atlantic Screw Works, Colt's Patent Fire Arms Manufacturing Company, Billings & Spencer. About 2,500 employees were affected. The fact that the labor men took this action does not mean that they have given up hopes of gaining the eight-hour day in this city. At this time there is arranged a program covering thirty weeks, providing for open meetings to organize the metal workers during the summer time.

Owing to the continuous and growing demand for the product of the Underwood Typewriter Company, and in order to meet the increasing opportunities which will follow the cessation of hostilities abroad, the concern has decided to add a series of large buildings to its plant, representing a total of 221,700 square feet and which extensions, when added to the present plant, will afford a total factory space of 828,240 square feet, or more than 19 acres of floor space. In addition to the new buildings, two of the factory wings which were built about ten years ago will be somewhat extended in length. The addition will cost about $400,000.

The Hartford Auto Parts Company has decided not to move its headquarters to New Britain, as was announced some time ago, but will retain the old Cheney Mill property in this city, to which it moved when forced to leave the Colt west armory in the fall. The present understanding is to operate the New Britain works, which are now being completed, as a branch. The company's business has increased rapidly of late, and New York and Hartford capital has been interested to such an extent that it is believed that the company will not only be able to take care of its indebtedness, but also operate both Hartford and New Britain factories. Stockholders have arranged to double the capital stock of the company from $300,000 to $600,000. The additional stock issue consists of $200,000 preferred and $100,000 common, making a total capital stock of $300,000 preferred and $300,000 common. The growth of the company in recent months has been surprising. Its business for February, 1916, was five times that of February, 1915, while monthly business lately has amounted to $60,000, as compared with $20,000 for last May. The factory has been put on a 24-hour basis and expects to do a $750,000 business during the present year.—T. C. W.

PROVIDENCE, R. I.

April 3, 1916.

There has been little change among the mills and factories engaged in the various branches of the metal trades of the State during the past month, and most of the plants are running better than full time in at least a part of the departments. There has been some trouble in a few of the establishments during the last few weeks because of dissatisfaction with working conditions and compensation.

The rush of business throughout the metal trades, which they have been enjoying since the war began, is increasing if anything and there is a constantly growing demand for skilled help of all kinds, with little supply. Domestic business is rapidly getting to be heavier than foreign orders, and most of the plants are reported to be well sold up through the greater part of the year.

The manufacturing jewelry industry is fairly active, according to the general reports that are received, and most of the factories are receiving enough business to keep their working forces together and the shops running on a full-time schedule. While the volume of business is not what it should be for this season of the year, there is considerable more activity than was shown a year ago, and the manufacturers are correspondingly satisfied.

The Metal Products Corporation has recently purchased a lot of land on Blundell street, adjoining the present property of the concern, which is to be utilized for the expansion of the plant.

H. J. Astle & Company, 118 Orange street, have just completed a large shipment of Boland patented blowers to the Chadwick Brass Company at Hamilton, Canada. They are also building a special No. 9 Boland blower which is to be driven by motor power for John Olson who conducts a hardening and tempering establishment at 120 Clifford street, this city. This blower is calculated to have a speed of at least 125 revolutions per minute and to take care of all the hardening furnaces in the plant. Astle & Company is also installing a Boland exhaust and dry-dust collecting system in the plant of George Price, 78 Friendship street, which is to connect with the grinding and buffing wheels.

The United Wire & Supply Company has filed a petition with the Cranston City Council, asking for tax exemption for a period of ten years, in the event that the company should build a $150,000 plant employing at least 200 hands on land adjoining that of the Standard Machinery Company on Elmwood avenue, on which the wire company holds an option.—W. H. M.

BUFFALO, N. Y.

April 3, 1916.

The metal trade in this city is fairly brisk, and judging from present conditions this prevailing briskness will continue for some time to come. War orders, everywhere, are given a preference to domestic trade, and collections are said to be very poor. There are two things which continue to bother all of the non-ferrous dealers—prices of raw products and supplies. As a result of this continuous raising of prices, few concerns are catering to blanket or long-term contracts.

Then take the domestic customer, he does not like the idea of advancing prices, in spite of the fact that he knows that the foundryman or electroplater has to pay more for his supplies. He argues that when a man does business with another for a long time he ought to make a concession in his price. If he refuses then he carries his work elsewhere—one who is willing to cut his just profits. This has annoyed some of the foundrymen tremendously. The platers on the other hand have not raised their prices in spite of the raise in supplies. Thus, they say, they have avoided the so-called "throat-cutting," but instead have been losing money on their work. Also, there appears to be a scarcity of certain chemicals. Platers say that brushes are also very difficult to get. They claim that the manufacturers say that bristles and blocks are very hard to get due to the present war.

As a result of the foregoing conditions, some of the local men have ventured to say that a minimum price should be decided upon by all of the dealers, and thus avoid the losing of just profits. Whether such a plan could be worked out, some think doubtful.

The heavy snows which have covered the country in and about Buffalo, the embargo and the scarcity of freight cars, have delayed trade considerably. One firm asserts that they were compelled to wait four days before the railroads were able to supply them with a freight car. The finishing and rolling mills and a few other concerns were those which were most troubled.

The foundries are as busy as they were when last reported; since then, however, one change has taken place, that is the scale of wages of the moulders and coremakers. On the first of March, the workmen made certain demands, and to avoid a strike of a serious nature, the foundrymen got together and offered a compromise to the workmen which they accepted. The moulders' wages were increased from $3.25 to $3.75, while the coremakers' wages were increased from $3.00 to $3.50 a day, and a nine-hour day was agreed upon.

Schnell Bronze Bearing Company, Inc., was recently awarded the contract to make all of the brasses for the "Hawk," the Buffalo Naval Militia man-of-war. They report a brisk trade since the first of the year. The Unique Brass Foundry has also landed a few big contracts which will keep them busy for some time to come.

Charles Berma, president of the American Bronze Company, has resigned his position and Charles Knorr has returned to the executive forces of this company. They have been very busy during the past two weeks.

The electroplaters are enjoying a good spell of business. The prospects of the future are very good, and as a building boom is expected to take place in Buffalo this spring and summer, every plater is expecting considerable volume of fixture work. Besides, fewer men are out of work, and wages are being increased all along the line. This will result in an extra trade, as the platers believe that the laboring element will now begin to get their tarnished wares replated which they have hitherto neglected.

The Fries Plating Company have booked several big galvanizing contracts. The Washington Plating Works are enjoying a nice volume of trade. They also report that they soon will begin the manufacture of a combination, corner and straight, brace which was invented by Christ Haberlei, one of the members of the firm.

A brisk trade continues to prevail among the finishing and rolling mills. Most of the output is for export, the Buffalo Brass and Copper Rolling Mill having made several additions to their plant during the past two months. G. W. G.

NIAGARA FALLS, N. Y.

April 3, 1916.

With the arrival of spring, trade in this market is taking a new hold on progress. Each week, the dealers maintain, is adding an increased volume of business. Labor is inclined to be scarce and wages are high. Prices on work are high, due of course, to the advance of prices in raw products. The spring and early summer trade is expected to be good.

The foundries are very busy and with little signs of a period of quiet for some time to come. The prices which they are receiving for their work is said to be very satisfactory. Because of the increased activity of a number of manufacturing concerns the local foundries will be able to keep themselves busy for several months at least.

Because of scarcity of cars in this part of the country, the Titanium Alloy Manufacturing Company have been delivering their castings with their motor trucks, anywhere within a radius of twenty-five miles. The experiment has been so successful that they expect to continue doing so. They find that it is possible to make deliveries more quickly and more cheaply. This firm is very busy at present making bearings for the Pierce-Arrow Motor Car Company of Buffalo.

The Frontier Brass Foundry is at present very active making castings for a number of the new concerns which are building in this city.

The Spirella Company is slowly increasing its capacity.

Mr. C. E. Leffel expected that this year will end up as a very busy one.

The Niagara Searchlight Company have begun the operations of enlarging their establishment.

Within the next month, the Oneida Community, Ltd., of Oneida, N. Y., will complete their plant at Niagara Falls, Ont., Canada. Mr. Reeve and Mr. F. J. Van Auken will have charge of the local branch.

Within the past six weeks a new industry has sprung up in the Cataract City, that is the manufacturing of metallic magnesium. At present the light metal works is located in a small, one-story, brick factory along the gorge.

Trade in the silverware and jewelry market is unusually good at this season of the year, most of which, no doubt, is due to the anticipated summer trade with the tourists who pass through this city.

In order to keep pace with their increasing volume of business the Carborundum Company have purchased two additional factories which adjoined their old quarters.

The Niagara Falls Board of Trade announces that the Philpott & Leuppie Company of New York City are soon to build a wire stretching machine plant in this city.

The Acheson-Graphite Company are doubling the size of one of their local plants. G. W. G.

COLUMBUS, OHIO

April 3, 1916.

The metal market in Columbus and central Ohio territory has been active during the past month. Trade has been good along most lines. Some little weakness appeared the latter part of March, but that condition is believed to be only temporary. Buying is practically all for immediate delivery, and users are not accumulating surpluses. The tone of the market is fair, and future prospects are considered good if not bright.

Copper is a little weaker than a month ago, due entirely to outside influences. To the trade it is now quoted at 24.75 to 25. Brass is also slightly weaker, but prices have not declined materially. Red scraps are selling at 19½ to 20½ cents, while yellow scraps are quoted at 16½ to 17 cents. Aluminum is stronger and is probably the best feature in the market. Scraps to the trade are quoted at 50 cents. Babbitt metal is moving well, and the same is true of type metals. Tin is weaker, being quoted at 48 to 49 cents. Zinc is also a little weak, the quotations being 17¾ to 18½ cents. Other metals are generally unchanged.

The addition to the plant of the Ohio Metal Company, located at Fourth avenue and Fourth street, Columbus, will be started soon. The feature of the improvement will be the erection of a brass foundry for refining. It is expected that the addition will be completed within six weeks. Henry Loeb is at the head of the concern.

Papers have been filed decreasing the authorized capital of the Newark Stamping & Foundry Company of Newark, O., from $50,000 to $35,000.—J. W. L.

DETROIT, MICH.

April 3, 1916.

The spring of 1916 is opening up with wonderful strides in the brass and aluminum field in Detroit. Manufacturers say that never in their history have they seen such a rush of business.

Many of these concerns have brought thousands of workmen into the city from other towns and as a result it is difficult to find suitable housing for them.

The Roberts Brass Company has about completed additions to its plant that will increase its capacity about two-thirds. These new structures will be ready for occupancy in a few weeks. They are said to be about as complete factory buildings as can be found anywhere in the country. This company, it is learned, is manufacturing no munitions, but devotes its time to the production of automobile parts. It also is manufacturing valves for gas range stoves, steam engine and boiler trimmings.

The Detroit Heating & Lighting Company, whose plant is at Lieb and Wight streets, has just erected a new structure for office accommodations and also an addition to the plant for copper and sheet metal work. F. B. Joy, general manager, reports the company's business has become so heavy it was forced to make these extensions. The company also has extensive japanning ovens and a plating department.—F. J. H.

Metal workers of Detroit and vicinity report business still active and prospects for a banner year are developing this spring above all expectations.

The continued demand for made-in-Detroit articles is the keynote of conditions throughout the country, and more especially in the brass manufacturing line which is one of the leading industries in this city.

Should the war be declared at an end next week, it would not injure business here this year, but would prove the opposite, for when the period of rebuilding abroad comes Detroit-made goods will play an important part, owing to the variety of goods manufactured in the non-ferros metal line.

The Clayton & Lambert Manufacturing Company are working night and day to fill their orders.

The Canadian Detroit Lubricator Company, located at Walkerville, Ont., are running their plant to the full limit and installing a large amount of new machines and tools to increase their production.—P. W. B.

CINCINNATI, OHIO

April 3, 1916.

Operation of all of the trades involving the use of metal and metal workers continues on an extremely active basis in this vicinity, virtually no diminution in the speed being noticeable, except here and there. The machine-tool shops, which have for a year furnished a high spot in the industrial field, continue to move at their best rate, some operating in two shifts a day and consuming a proportionate amount of material in the process. There is no scarcity of orders, but there is not infrequent trouble in getting both material and men. Prices of metal are rising to a point where, under normal conditions, they would be almost prohibitive, but nobody hesitates now on account of price. The only question is when delivery can be made; and, as stated, this may furnish a serious problem. High wages and unprecedented activity in machinery work all over the country have naturally operated to bring about a scarcity of men, and good machinists are, therefore, even harder than usual to get and keep. Aside from these factors, the machine-tool people have nothing to worry about. Rumors of an early conclusion of the war do not constitute a threat to the big business brought by the war, for the reason that, as a rule, the contracts are protected by an agreement guaranteeing profits and the cost of extra material; and, moreover, it is pretty generally agreed that rumors of peace are rather premature at this time. War orders have also revived the distillery trade, which up to a few months ago was in a much-depressed state on account of the limited production and still more limited demand. For some time, however, all of the distillery plants in this vicinity have been operating at capacity on the production of spirits, which are largely used in the manufacture of high explosives. Only the congestion of railroad traffic has interrupted this activity, and coppersmiths have consequently had much more to do than they expected—in repairs and new work for the distillers. On the whole, therefore, the revival in business in the metal trades due directly to the war bids fair to continue for some months at least, and local concerns and their employes are making the most of it.

At the annual meeting of the National Metal Trades Association, Cincinnati section, held here on March 2 at the Sinton Hotel, the following officers were elected: President, A. H. Tuechtor; vice-president, J. B. Doan; secretary, T. A. LeBlond, and treasurer, William Emmes. These officers, with Murray Shipley, C. H. Fox and E. A. Muller, constitute the executive committee. The meeting was followed by a dinner.

The Buckeye Iron & Brass Works, Dayton Pump Manufacturing Company, Kramer Brothers Foundry Company, Miami Brass Foundry Company, Patterson Tool & Supply Company and a number of other concerns in various branches of the metal trades were prominent among the exhibitors and participators in the Dayton Industrial Exhibit held recently in Dayton, O.

The high price of copper and other metals has served to stimulate the activities of wire and metal thieves lately, numerous reports relating theft of telephone wire, automobile supplies and other goods containing salable metal. Several men were recently arrested at Troy, O., following an attempt to sell a quantity of copper telephone wire to a junk dealer, while at Zanesville a dealer was fined for receiving metal alleged to have been stolen. —K. C. C.

LOUISVILLE, KY.

April 3, 1916.

A general improvement has been noted in the copper industry of Louisville during the month, according to most of the leading members of the trade. There is an active demand for various lines of copper goods in spite of the high cost of materials and finished goods. Manufacturers in various lines, who were far from busy a few months ago, are now rushed with orders since things began picking up. The biggest development in the trade is in the distillery end, where many manufacturers of beverage spirits are now remodeling their plants in order that they may manufacture grain alcohol. Several of the largest copper working establishments report that they have orders on hand which will keep them going for six months or more.

Copper has continued to soar in price during the month and quotations on carload lots, delivered in Louisville, quoting from the base price, are about as follows: sheet, 34½c.; ingot, 31 to 32c.; tubes, 39 to 40c. Standard tubes of the size most generally used are worth in the neighborhood of 50c. per pound.

The plating business is picking up as well as brass work, according to George Stege, of the Stege-Rindt Company. The concern is handling only plating and brass work at this time. According to Mr. Stege business promises to be very active this summer on account of the large building operations which have been undertaken.

Nine thousand pounds of bronze elevator gears are keeping the force at the Independent Brass Foundry busy for the time being. The concern has also received a large order from the government for packing rings to be used on battleship engines, etc. J. W. Rademaker, head of the concern, said that he had work enough on hand to keep the casting force busy for at least two months.

Matt Corcoran & Company is another copper-working concern which has all of the work that it can handle for about six months. The company recently received a job on one of the largest distilleries in the state. Slow deliveries of material will delay many of the coppermen on getting started on distillery work, as it is taking four to five weeks to get sheet copper and from four to five months to get some tubes.

Night and day shifts have been put to work at the Vendome Copper & Brass Company's plant. C. J. Thoben stated that the company was having more trouble in stalling off people who want work done than in getting business, and they are being turned down in some cases. The company has awarded a contract for an addition to its foundry at 721 East Main street.

A recent fire which started in the molding shop at the plant of the Ahrens & Ott branch of the Standard Sanitary Manufacturing Company, was put out before it had obtained sufficient headway to do much damage.

The high price of copper and other metals has been responsible for a great deal of thievery of late. Three men were recently arrested in Louisville for having cut fifty feet of the main cable of the Western Union Telegraph Company, between Louisville and Chicago. Telegraphic communications were cut off for several hours and four railroads using the cable were forced to operate by telephone. The Louisville Railway has had trolleys cut on its interurban lines, and rail connection cut loose and stolen.

The Aluminum Company of America, Maryville, Tenn., is preparing to start work about May 1 on hydro-electric power developments on the Little Tennessee River. The company will generate its own power for operating its plant.

TRENTON, N. J.

April 3, 1916.

Trenton plants turning out metal products continue busy and the wheels of progress are still humming here. The European conflict was responsible for the plants operating at full time again, and the owners are hopeful that orders can be secured to keep them running full-handed all summer. Labor unions are taking advantage of the increase in business and the fact that many more metal workers are now working to increase the membership of the various locals. Men go quietly about the plants at noon hour and urge men to join the union and better his condition. They find this a profitable plan to further unionism. Owners of metal plants in this city do not take very kindly to labor organizations, and the majority of the shops are conducted on the open plan—employing both union and non-union help.

The Ingersoll-Trenton Watch Company has cut down its night force. Instead of operating every night in some of the departments, as was done during the winter, the company is only running a couple of nights a week. The McFarland Foundry & Machine Company finds business conditions improving in the brass and bronze departments.

The J. L. Mott Company is trying to avert labor trouble, so it can complete the two big orders for time fuses for the European nations in time. The polishers and brass finishers were recently granted voluntarily an increase of 50 cents a day. This applied to those not working piece work. All the employes of this big plant were, some time ago, given a Saturday half-holiday. The moulders were also given an increase. The company was recently compelled to cut the working days down to three days a week in the brass department because of a scarcity of material, the embargo on freight being responsible for these conditions. Other Trenton plants are experiencing the same trouble in getting material.—C. A. L.

NEWARK, N. J.

April 3, 1916.

In volume business is increasing in Newark and vicinity. Fundamentally conditions are also improving, but improvement is not as great as it should be, due to the fact that business is not free to move along natural lines. Prices on all kinds of materials are constantly going up, but this is especially true of materials needed for war supplies. Consequently manufacturers of goods for sale in regular business channels made from these materials are hard hit. The warring nations must have supplies and will pay anything within reason to get them. Manufacturers in legitimate lines cannot afford to pay so much for their regular line of goods, and the market is therefore pretty well drained for use abroad. Such materials of certain kinds as must be purchased to supply customers must be paid dearly for, and it is often several weeks, or even months, after an order has been placed before the goods are delivered. Frequently only a part of the order comes through then.

This condition is, as shown above, partly due to the great demand abroad and to the growing scarcity of the metals, but it is also in part due to the freight congestion, which makes it almost impossible for manufacturers to plan on the arrival of material, and consequently hinders them from promising goods to their customers at any specified time. The freight congestion also hinders prompt deliveries of the finished products. Deliveries to points comparatively near sometimes take several weeks. Some materials, the supply of which comes from abroad normally, is scarce and in some instances scarcely obtainable, because of the blockade and other war conditions. Platinum is almost impossible to get, except for scraps gathered from far and near, which are being melted up to help supply the demand. These conditions not only pertain to metals, but also apply to chemicals, and manufacturers who use the various chemicals in their manufacturing processes are hard pressed indeed to get adequate supplies, or if they do get them must pay unusually high prices. All of this means that the prices of the finished products have had to be raised. High prices are always a check on business to some extent, and the present high prices mean that many orders which can wait will not be placed until conditions are more favorable.

The electro-plating firm of Smith & Brannan, 105 Oliver street, has been sold out and the firm name hereafter will be the Smith, Brannan Electro-Plating Company, Inc., and they will continue to do a general electro-plating business. The officers of the new corporation are as follows: President, Edmund P. Kohn; vice-president, William R. Skillman; secretary, Charles Stiehle; treasurer, Oscar W. Kohn.

The A. F. Conery Company, manufacturers of polishing brushes, buffs and supplies at 14 Oliver street, reports that although business is good at the present time the cost of all materials is so high that there is not the profit there should be. In some instances it has been found necessary to raise the prices of the finished products to offset the rise in the cost of materials. —R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Cleveland Metal Products Company, Cleveland, Ohio, will construct an addition to its plant at 1141 Ivanhoe road, at an estimated cost of $20,000.

The annual report of the National Lead Company of New York shows assets $53,458,969.81. Liabilities $47,721,607.87, leaving a surplus December 31, 1915, of $5,737,361.94.

George Kingdon Parsons, consulting engineer, announces the location of his main offices in the Equitable Building, 120 Broadway, New York City, in addition to offices in the Riggs Building, Washington, D. C.

The published report of the Maiwurm Aluminum Company, Pittsburgh, Pa., regarding their proposed plant at Sistersville, W. Va., is stated, by the company, to be premature as the corporation is still undergoing promotion.

The Farrel Foundry & Machine Company, Ansonia, Conn., report that the small building, 48x100 feet, two stories high, which they are erecting is intended merely as a housing for the plumbing department which will shortly be moved into it.

The New Jersey Zinc Company, 55 Wall street, New York, announces the following organization changes effective March 1: E. V. Peters, assistant general sales manager; A. H. Peck, sales manager; H. Hardenbergh, general purchasing agent, and W. J. Lee, Jr., purchasing agent.

The Crescent Metal & Manufacturing Company, Freemont, Ohio, reports that nothing definite has been decided regarding the erection of a new building for which, it was reported, plans had been prepared; as it has an option on a building that is already completed.

The Webster & Perks Tool Company, Springfield, Ohio, has leased additional space in the Shuey Factories Building that will enable it to greatly increase its present output of machine tools, grinding and polishing machinery, which is continually on the increase.

The Lindholm Metal Stamping Company, manufacturer of brass and steel stampings, etc., 107 Erie street, Camden, N. J., has completed an addition, 38x50 feet, and has awarded contracts for the erection of two buildings, 28x44 feet, and 21x35 feet, which will provide additional manufacturing space.

The Aluminum Specialty Company, Seventeenth and Wolmer streets, Manitowoc, Wis., has awarded contracts for a two-story reinforced concrete and steel addition, 40x60 feet. Polishing, stamping, spinning, and tool rooms and machine shop are among the departments operated by the company.

The International Forge Company, manufacturer of brass forgings, Pottstown, Pa., through George T. Jacocks, general manager, advises that the recent report that its operations had been delayed by non-receipt of equipment, is incorrect, and that the company is now operating with unusual success.

The Hoover Suction Sweeper Company, New Berlin, Ohio, is in the market for equipment for an aluminum foundry, 40x 80 feet. Besides an aluminum foundry this company also operates a brass and bronze foundry, brass machine shop, tool room and stamping, plating, polishing and lacquering departments.

As an illustration of the freight congestion in the Naugatuck Valley it is interesting to note that the Randolph-Clowes Company, Waterbury, Conn., is unloading eight hundred tons of ingot electrolytic copper from barges at the Crane Company's dock in Bridgeport, Conn., to cars for rail shipment to Waterbury.

C. R. Kammerer, president of the Pittsburgh Galvanizing Company, Pittsburgh, Pa., is interested in a new organization which intends to manufacture brass cartridge shells and desires to get in touch with manufacturers of machinery for drawing seamless brass and copper tubing and machines for forming brass cartridge shells.

The Milwaukee Brush Manufacturing Company, Milwaukee, Wis., hasbeen organized to manufacture wire, bristle and fibre brushes and brooms of every description, such as are used in foundries, machine shops, plating establishments, etc. The new company is capitalized at $50,000 and E. F. Streich is president and F. D. Jacobs, vice-president.

A new Japanese aluminum plant is reported to be established at Kachigawa, near Nagoya, with a capital of $498,000. A rich deposit of clay nearby is to be used. Cessation of aluminum imports has advanced the price of the metal to such an extent that two of the three manufacturers of aluminum articles have been compelled to shut down.

H. D. Kramm, 917 Fletcher Trust Building, Indianapolis, Ind., has sold his interest in the Pioneer Brass Works and has incorporated a company for the manufacture of malleable aluminum castings and finished pistons. The new company is now operating at its factory at 1116 East Georgia street. The Pioneer Brass Works will continue to manufacture malleable aluminum castings under a royalty.

The Jankins Manufacturing Company, Bloomfield, N. J., manufacturer of castings, will build an addition, 12x30 feet, to its foundry on Farrand street. The company reports that they are not in need of any kind of machinery. A brass, bronze and aluminum foundry, brass machine shop, tool room and spinning, tinning, soldering, plating, polishing and lacquering departments are the different departments operated by this concern.

The Apothecaries Hall Company, Waterbury, Conn., have placed upon the market a material which they call potnitro compound, which is intended to take the place of saltpetre. It is stated that this material may be used for pickling and fluxing operations for which saltpetre has usually been employed and equally as good results may be obtained.

Full information relating to potnitro may be obtained by corresponding with the above company.

The United Smelting and Aluminum Company, New Haven, Conn., manufacturer of aluminum ingots, alloys, rods, etc., have opened a branch office at 24 Stone street, New York, N. Y. C. J. Wolfe, formerly connected with the Aluminum Company of America and lately with the Cleveland Metal Products Company, Cleveland, Ohio, will have charge of this office, which has been opened to receive inquiries for all products manufactured by the company.

The Moser Pattern & Foundry Company, the Newark Stamping Company and the Huffman Plating Works, Newark, Ohio, have been consolidated as the Newark Stamping & Foundry Company and capitalized at $50,000. The officers of the new company are Charles F. Sites, president; Fred W. Moser, vice-president; Harvey J. Alexander, secretary, and Eugene F. Ball, treasurer and manager. The company will operate a bronze and aluminum foundry and spinning, stamping, galvanizing, plating, polishing, japanning and lacquering departments.

The Snyder Electric Furnace Company of Chicago, Ill., recently added to their staff of metallurgical engineers, Robert M. Keeney, who will be in charge of all development work. Mr. Keeney has had a broad experience in electric furnace research, covering the production of iron, steel and ferro-alloys in the electric furnace, and the electric smelting of lead, copper and zinc ores. His work has been especially directed toward the production of ferro-alloys and electric smelting. In this connection he visited many electric furnace plants in Sweden, England, France and Germany.

J. W. Johnson, manager of the Kokomo Brass Company,

Kokomo, Ind., has awarded the contract for a new brass and aluminum foundry, 300 x 55 feet, which, it is expected, will be completed the middle of May. Mr. Johnson reports that the increased production of the factory made it necessary for the construction of the foundry, and that about fifty more men will be employed when the building is completed. A brass, bronze and aluminum foundry, brass machine shop, tool and grinding room, stamping, plating, polishing and lacquering departments are operated by this company.

A fully equipped commercial chemical testing laboratory has been opened by the Wolverine Laboratories Company at 445 Howard street, Detroit, Mich., with L. F. Miller, formerly chief chemist of the Timken-Detroit Axle Company, in charge. The company will specialize in analyses of coal, oils and metallic alloys of all kinds, and has succeeded the Charles E. Wade Sales Company, as sales agent for the Montgomery Chemical Works, Inc., Baltimore, Md., manufacturer of carbonizing compounds, for Michigan, Ohio, Indiana, Illinois and Wisconsin.

American exporters will shortly have an opportunity to land goods in Russia without interference or delay from government shipments. The American-Russian Chamber of Commerce, 60 Broadway, New York, has received a cablegram from the Russian-American Chamber of Commerce in Moscow announcing that the Pacific port of Nikolaievsk, at the mouth of the Amur River, Siberia, will be opened for navigation June 14. American exporters wishing to avoid the congestion and delays in sending freight by way of Vladivostok should direct steamers to Nikolaievsk. Goods received there will be transported up the Amur River to Stretyinsk, where connection is made with the railroad system.

Woolsey McA. Johnson, consulting engineer, reports that J. E. Hildt of Tulsa, Oklahoma, is about to build a zinc retort plant that will be the last word in zinc metallurgy. This plant, the location of which has not been fully decided upon, will include a refinery which will make a specialty of producing strictly high grade spelter, analyzing 99.92 per cent. zinc. A specially refined Prime Western and Brass Mill Special freed from dross by a simple process will be made later. Particular attention will be paid to making the slabs of uniform composition.

The ore that will be used is to be largely commercially desirable flotation concentrates. In the fall a lead plant, to extract the gold, silver, copper and lead values is contemplated; also perhaps an acid plant utilizing the sulphur in the ore to make a 98 per cent. sulphuric acid for oil refineries will be erected.

IROQUOIS FOUNDRIES, INC.

The Iroquois Foundries, Inc., Utica, N. Y., has been incorporated under the laws of New York for $25,000. The company will make a specialty of Rath white metal, a non-corrosive, anti-acid metal taking a natural silver color without plating. This will take the place of nickel plated brass or bronze, where subjected to hard use and checking off and where acid and rust-resisting qualities are wanted, togther with strength. Tensile strength, pressure test and elastic limits exceed brass or bronze. At present castings and ingots will be made and in the near future equipment will be installed for rolling bars, sheets and rods. The manufacturing will be under the personal supervision of the president, Charles J. Rath, and the secretary, Harold E. Rath, foundrymen of wide experience in the manufacture of non-ferrous metals. The sales department will be in charge of the vice-president, Charles E. Day. Fred Widmer will be treasurer and general manager.

In addition to equipment usual to aluminum and brass foundries there will be installed immediately a modern plant for aluminum die casting, and in this connection the company would like to get in touch with manufacturers of such equipment.

ELECTION OF OFFICERS

At the annual election of officers of the Bennett-O'Connell Company, manufacturers of electro-plating and polishing equipment and supplies, Chicago, Ill., the following were elected for the ensuing year: Martin J. O'Connell, president and treasurer; Gus Creutz, vice-president, and Edmund J. Stack, secretary.

BUSINESS TROUBLES

Under date of March 7, Ernest C. Lum, receiver for the Finished Parts Manufacturing Company, Newark, N. J., issued the final dividend upon the claims against the defendant company.

FIRES

The plant of Elmer H. Catlin Company, Washington, D. C., manufacturers of gas and electric fixtures was partially destroyed by fire which caused damages to the amount of $30,000. The departments of the plant included a machine shop, plating, polishing and lacquering department.

T. C. Sheehan, vice-president of the Durham Duplex Razor Company, Jersey City, N. J., reports in reference to the fire which visited his plant on March 22, that some of the machinery came through in good shape while some was totally destroyed and it was a question how much of the stock can be used. He states that the Hanson and Van Winkle Company of Newark, N. J., were at once on the job and turned over what electro plating apparatus and supplies they had on hand in order to allow the Durham people to continue business as promptly as possible. At this writing it is impossible to furnish any definite amount of the loss sustained.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture metal goods, etc.—The Jacob Kaufman, Limited, Berlin, Ont., Canada. Capital, $250,000. Incorporators, Jacob Kaufman, Milton R. Kaufman and others.

The Enterprise Brass Works, Muskegon Heights, Mich., has been incorporated with a capital of $175,000 and will operate the following departments: brass, bronze and aluminum factory, tool room and plating department.

To manufacture and sell metal and wire goods.—National Manufacturing Company, Worcester, Mass. Capital, $1,000. Incorporators, Paul B. Morgan, president; Charles F. Morgan, treasurer and Ralph L. Morgan. The company will operate a tool and grinding room, cutting-up shop and stamping, tinning, brazing, soldering, plating, polishing and japanning departments.

The Duplex Metallic Company has been incorporated at Conshohocken, Pa., to manufacture copper-clad wire and sheets under the patents of the Duplex Metals Company, Chester, Pa., which they have purchased from that company. The Duplex Metals Company is no longer in existence. B. C. Kenyon, for many years president of the Diehl Manufacturing Company, Newark, N. J., is president of the new company. The company is at present engaged in equipping its plant to roll this material and is in the market for re-heating furnaces, hot saw shears, roll lathe, mill gears, electric motors, machine shop, chemical laboratory, oil tanks, water tank, piping, rod coiler, water and oil pumps, scales, crucibles, graphite molds, pickling and cleaning tanks, etc.

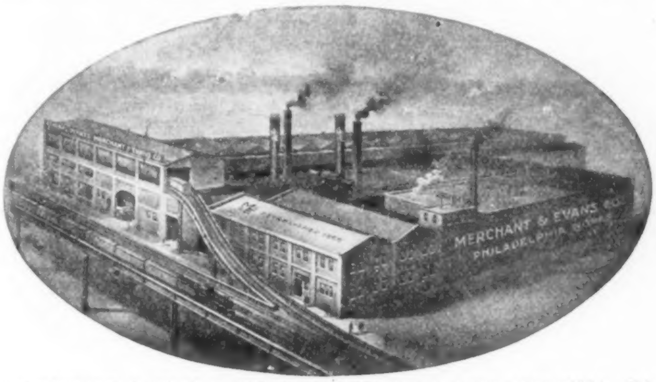
REMOVAL

The Ajax Metal Company, Philadelphia, Pa., has moved its New York office, A. MacDougall, manager, from Room 3915, Woolworth Building, to 233 Broadway, New York City.

MERCHANT & EVANS COMPANY

The Merchant & Evans Company, Philadelphia, Pa., has celebrated the fiftieth anniversary of its founding by removing its offices and warehouse to a large, modern building which it has erected adjoining its works on Washington avenue, between Twentieth and Twenty-first streets, in that city.

In 1866, Clark Merchant, who had retired from the United States Navy with the rank of lieutenant-commander, established the business in Philadelphia as Merchant & Company, dealing principally in brass, bronze and copper in all forms as then manufactured, and trading also in tin plate and other products that were imported from England and other countries.



MERCHANT & EVANS' NEW BUILDING AT PHILADELPHIA, PA.

The continued growth of the business made it necessary to open branch offices and warehouses at several points in the United States, and to enlarge the line of products handled. The co-partnership of Merchant & Company was changed to a corporation under the style of Merchant & Company, Inc., with Clark Merchant as its president. After Mr. Merchant's death, Powell Evans assumed control of the business, which then became the Merchant & Evans Company. The company now has plants in Philadelphia, Wheeling, and Chicago, and offices and warehouses in Philadelphia, New York, Baltimore, Cleveland, Chicago, and Kansas City. To satisfy the demand for its tin and terne plates, the company built a modern tin-plate mill at Warwood, W. Va., a suburb of Wheeling.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Chemical Products.—The Du Pont Chemical Works, New York, N. Y., has issued a small booklet giving description of the chemical products that they manufacture. These products include amyl and ethyl acetate, benzol, ether, bronzing liquids, pyroxylin, pegamoid aluminum paint, etc. Copies of this booklet may be had upon request.

Tungsten.—Carlisle & Company, 74 Broadway, New York, have prepared for free distribution a booklet entitled "Tungsten, Its Properties and Uses." It is very complete and contains extracts from the United States Geological Survey. In view of the present activity in the Tungsten market, it should prove most interesting reading.

Metallographic Supplies.—The Scientific Materials Company, Pittsburgh, Pa., has issued a catalog which fully describes and illustrates their extensive line of materials necessary for the preparation of specimens for microscopic examination. This company furnishes all the special apparatus which is also included in the catalog.

Dipping baskets—A compact and comprehensive catalog describing and illustrating dipping baskets for plating, tinning, machine work, etc., made of brass and copper wire, has been issued by John P. Smith & Company, New Haven, Conn. These articles of wire range from the ordinary run of dipping basket to railings and grills for offices and hotels.

Perforated metal—Edwin B. Stimpson & Son, Brooklyn, N. Y., have issued catalog No. 70, which gives a full description and photographs of the extremely varied line of perforated metal sheets which this company produces. A number of tables of weights and measures giving the weight per square foot of copper and brass sheets are included in the booklet.

Carbon-Free Metals.—The Goldschmidt Thermit Company, 90 West street, New York, have issued a very valuable calendar in the shape of a hanger containing a map of the United States divided so as to show the changes of time in the different parts of the United States. The subject matter on the calendar relates to the products of this company, such as carbon-free metals and alloys.

Dynamos.—The Boissier Electric Company, of New York City, has issued a new catalog in which are given descriptions and illustrations of their "World" dynamo, mechanical platers and various types of rheostats made by this company. The new feature of this concern's activities is that they are now furnishing galvanizing plants and accurate information as to how to make and operate necessary solutions with the least expensive chemicals and also furnish instructions for operation of same.

Machinery—The Waterbury Farrel Foundry & Machine Company, Waterbury, Conn., have issued Catalog G, which includes chain draw benches and machinery for tube and rod mills. In this catalog may be found chain draw benches for light work, for special tubing and with power return. Also knuckle joint tube pointers with belt and motor driven cut-off saws for rods and tubes, bull blocks, wire tumbling barrels, tandem wire drawing machines and in fact all of the varied and multifarious machines necessary for the manufacture of seamless metal tubing.

Hardware—The W. Bingham Company, Cleveland, Ohio, hardware dealers, have issued a very handsome and attractive booklet which is a memorial of their seventy-fifth anniversary of the founding of the company. The booklet, which consists of twenty-four pages, contains a brief sketch of the business founded in Cleveland by William Bingham, a halftone of whom is included, and a description and illustrations of the new building into which the business was moved on January 1, 1916. From a literary standpoint the booklet is a work of art, being embellished, as it is, with facsimile prints of the old days of Cleveland.

Bronze castings—The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., have issued, in the interest of the bronze department, their 1916 edition of the standard alloy booklet. This booklet gives a full list of all the standard bronze castings manufactured by this company. Included in the above list are some thirty-three different alloys of copper, tin, lead, zinc, aluminum, iron, manganese, together with micrographs and descriptions of their physical properties. On the whole the booklet makes mighty interesting reading and we would advise any one who is interested in standard bronze castings to obtain a copy of the booklet which may be had free.

Metals.—U. T. Hungerford Brass & Copper Company, 80 Lafayette street, New York, with branches in Philadelphia, Boston, Baltimore and San Francisco, have just issued their latest catalog, consisting of over 400 pages, handsomely bound, illustrating the complete line of brass and copper sold under their well-known trade-mark Star Brand. The contents are classified in separate departments, thereby providing the trade with a concise price list, together with lists

showing material aggregating over five million pounds carried in stock ready for prompt shipment of such standard articles as copper and brass in sheets, rolls, rod and wire; seamless brass and copper tubes, condenser tubes; tobin bronze and yellow metal (muntz) rods; brazed brass and bronze tubes; German silver, phosphor bronze and commercial bronze; copper rivets and burs, braziers' rivets, copper nails and tacks; soldering coppers, solder, brass and iron chain; brass and iron escutcheon pins, wood and machine screws; brass and copper wire cloth and bronze mosquito netting; copper leaders and gutters, etc.; brass and bronze railings and fittings and numerous other items of interest to the brass and copper and allied trades.

CATALOG EXHIBIT

METAL MARKET REVIEW

New York, April 3, 1916.

COPPER

On March 1 the price of Electrolytic copper was between 28 and 28¼ cents according to the needs of the purchaser. During the month of February it was predicted, with any amount of emphasis, but we regret to say without a particle of truth, that spot and nearby copper was very scarce that there would not be enough March, April or May copper to supply the needs of consumers who were not already covered —29 cents was supposed to have been paid and 30 cents looked like a sure thing.

As a matter of fact there has been very little buying during March, the only trouble was to get the metal shipped to consumers. Prices have steadily declined the whole month of March from 28¼ on the first, to 26¾ cents cash New York for spot copper at the close.

From the slow buying and the small exports for the month —about 25,000 tons—possibly 56 million pounds—it is pretty well certain stocks of copper in America must have increased from 10 to 15 million.

There have been no special features to note during March, the market has been very dull and prices have declined about 1½ cents per pound and there has been more than enough copper around to take up the slow demand.

Lake at the close is quoted at 26¾ to 27 cents and Electrolytic at 26¾ for spot to about 26¼ for the later deliveries. Casting brands are offered at 15¼ to 15½ cents.

TIN

The tin market has been very sensitive and prices have shown wide fluctuations. Opening at around 47¾ cents, prices ran up to 56 cents on the tenth and then declined at the rate of about ½ cent per pound a day to 51 cents on the twentieth and close at around 50 cents.

LEAD

The lead market has been very active and owing to a persistent demand for export prices in the open market are about 1 cent per pound above the Trust price. The Trust price is 7 cents and at this price—or their monthly average price—the Trust claims to be taking care of their own consumers and they can only get what the Trust believes they absolutely need. The price asked by the Independents is from 7⅞ to 8 cents, but there is very little lead to be picked up and there are inquiries in the market for close onto 500 tons for export.

SPELTER

The spelter market has been quite active and on free selling prices have declined from 20¾ on March 1st to around 17 cents at the close. There has been some export demand from England and the market at the close is rather firmer.

ALUMINUM

The aluminum market has been rather more active. Some export business has been reported and consumers have bought for deliveries over the balance of the year. From 62 to 63 cents asked for No. 1 virgin early in March prices have sagged off to 58-60 cents for 98-99 virgin and 58-59 for pure remelt. No. 12 remelt alloy is offered at around 48 cents.

ANTIMONY

The antimony market has been very dull and prices for Chinese, Japanese and American have held around 44.50 to 45 cents at the close.

QUICKSILVER

The demand has not been so urgent since the British Government allowed 600 flasks to be shipped to the munition makers for the Allies and prices have dropped from around $310 per flask to $190 per flask at the close and the indications are that prices will be considerably lower.

SILVER

The silver market has been quite active and prices have been higher than for some years: 60¾ cents was reached in New York market, owing to a combination of circumstances, some of them entirely outside the market situation. At the close the market is rather easier at 59¾ cents in New York.

PLATINUM

The market has been held steady at around $88.00 per ounce for limited quantities.

SHEET METALS

Sheet copper has gone off about ½ cent per pound to 34½ cents base while copper has gone off fully 1½ cent per pound. High sheet brass is quoted at the same price as a month ago but this can surely be shaded. Copper wire is obtainable today at about 28½-28¾ cents against 29¼ a month ago.

OLD METALS

The old metal market has been dull and easier owing to the sagging copper market. Consumers have held off and it has been very difficult to make any satisfactory turns in the market.

J. J. A.

DAILY METAL PRICES

MARCH MOVEMENTS IN METALS

	Highest.	Lowest.	Closing.
Copper.			
Lake	28.25	27.25	27.25
Electrolytic	28.25	27.25	27.25
Casting	26.75	25.50	25.50
Tin	56.00	49.50	49.25
Lead	8.00	6.55	7.75
Spelter	20.75	17.25	17.75
Antimony (Chinese and Jap.)	45.00	44.25	45.00
Silver	60¾	56⅝	59½

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper. 1915—Average for year, 18.94. 1916—January, 24.75. February, 27.75. March, 28.

Brass Mill Spelter. 1915—Average for year, 17.50. 1916—January, 22.25. February, 22.75. March, 23.15.

Metal Prices, April 3, 1916

NEW METALS.

	Price per lb. Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	27.00
Electrolytic, carload lots	27.00
Casting, carload lots	25.75
TIN—Duty Free.	
Straits of Malacca, carload lots	50.00
LEAD—Duty Pig (Bars and Old 25%; pipe and sheets 20%. Pig lead, carload lots	8.00
SPELTER—Duty 15%.	
Brass Special	20.00
Prime Western, carload lots, nominal	18.00
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½. per lb.	
Small lots, f. o. b. factory	72.00
100-lb. lots, f. o. b. factory	66.00
Ton lots, f. o. b. factory	63.00
ANTIMONY—Duty 10%.	
Cookson's cask lots, nominal	.....
Hallett's cask lots, nominal	.....
American	44.50
Chinese, Japanese	44.50
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot, Placquettes, Ingots, Blocks	45.00
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	5.00
BISMUTH—Duty free	nominal
CADMIUM—Duty free ....nominal	1.80
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty, 10% per flask of 75 pounds	225.00
GOLD—Duty free	$20.67
PLATINUM—Duty free ....$88.00 to	100.00
SILVER—Government assay—Duty free	.56¾

INGOT METALS.

		Price per lb. Cents.
Silicon Copper, 10%	according to quantity	36 to 38
Silicon Copper, 20%	" "	38 to 40
Silicon Copper, 30% guaranteed	" "	40 to 42
Phosphor Copper, guaranteed 15%	" "	36 to 40
Phosphor Copper, guaranteed 10%	" "	34 to 38
Manganese Copper, 30%, 2% Iron	" "	45 to 50
Phosphor Tin, guaranteed 5%	" "	65 to 70
Phosphor Tin, no guarantee..	" "	44 to 47
Brass Ingot, Yellow	" "	22 to 24
Brass Ingot, Red	" "	20 to 22
Bronze Ingot	" "	22 to 25
Parsons' Manganese Bronze Ingots	" "	31½ to 33
Manganese Bronze	" "	30 to 33
Phosphor Bronze	" "	24 to 26
Casting Aluminum Alloys	" "	45 to 50

PHOSPHORUS—Duty free.	
According to quantity	35 to 40

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
22.00 to 23.00	Heavy Cut Copper	25.00 to 26.00
21.00 to 22.00	Copper Wire	24.00 to 25.00
18.00 to 19.00	Light Copper	21.00 to 22.00
17.00 to 17.50	Heavy Mach. Comp	18.50 to 19.00
13.50 to 14.00	Heavy Brass	16.00 to 16.50
11.00 to 12.00	Light Brass	13.00 to 13.50
14.00 to 15.00	No. 1 Yellow Brass Turnings	15.50 to 16.00
14.00 to 15.00	No. 1 Comp. Turnings	16.00 to 17.00
6.50 to	Heavy Lead	.... to 7.00
12.00 to 13.00	Zinc Scrap	14.00 to 15.00
25.00 to 30.00	Scrap Aluminum Turnings	25.00 to 30.00
30.00 to 35.00	Scrap Aluminum, cast alloyed	25.00 to 30.00
35.00 to 40.00	Scrap Aluminum, sheet (new)	45.00 to 50.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 24.00	Old Nickel	20.00 to 24.00
20.00 to 24.00	Old Nickel anodes	20.00 to 25.00

PRICES OF SHEET COPPER.

BASE PRICE, 34.50 Cents per Lb. Net.

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

ZINC— Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill......25 cent basis, less	8%
Casks, jobbers' prices	26
Open casks, jobbers' prices	26½

Metal Prices, April 3, 1916

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect March 20, 1916.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.38	$0.39	$0.40
Wire	.38	.39	.40
Rod	.38	.40	.41
Brazed tubing	.43	—	.45
Open seam tubing	.43	—	.45
Angles and channels	.43	—	.45

To customers who buy 5,000 lbs. or less per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.40	$0.41	$0.42
Wire	.40	.41	.42
Rod	.40	.42	.43
Brazed tubing	.45	—	.47
Open seam tubing	.45	—	.47
Angles and channels	.45	—	.47

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

31c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	35c.	per lb. base
100 lbs. to 800 lbs. in one order	35½c.	" " "
Less than 100 lbs. in one order	37c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5 6

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch		
½ inch		
⅝ inch		
¾ inch		
⅞ inch		
1 inch		
1⅛ inch		
1¼ inch		
1½ inch		
1¾ inch		
2 inch		

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Red	40c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	37c.	" "
Muntz or Yellow Metal Rectangular sheets other than Sheathing	40c.	" "
Muntz or Yellow Metal Rod	38½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 52c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 7c. over Pig Tin. 50 to 100 lbs. 8c. over, 25 to 50 lbs. 15c. over, less than 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

Gauge.	Width. Inches.	1 ton.	50 to 2,000 lbs.	Less than 50 lbs.
20 and heavier	3-30			
	3-30			
21 to 24 inclusive	30-48			
	48-60			
25 to 26	3-30			
	30-48			
27	3-30			
	30-48			
28	3-30			
	30-48			
29	3-30			
	30-48			
30	3-30			

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.																	
12.	.109.																	
14.	.083.																	
16.	.065.																	
18.	.049.																	
20.	.035.																	
21.	.032.																	
22.	.028.																	
24.	.022.																	

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	44c.	16%	48c.
8%	45½c.	18%	48½c.
10%	46c.	20%	51c.
12%	47c.	25%	60c.
15%	47½c.	30%	66c.

GERMAN SILVER WIRE.

Quality	Net per lb.	Quality.	Net per lb.
5%	47c.	15%	53¾c.
8%	49c.	16%	54¼c.
10%	50½c.	18%	56¼c.
12%	52¼c.	30%	71½c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.